AUGUST, 1952

APPLIED HYDRAULICS

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THE MAGAZINE OF FLUID POWER TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS

DESIGNED FOR SAFETY . . . . . Pg 37
SAVING SPACE . . . . . Pg 40
ACCURATE SPEED REGULATION . . . . . Pg 42
CONTROLLED PRESSURE AND FORCES . . . Pg 45
AUTOMATIC OPERATION . . . . . Pg 50
AIRCRAFT SYSTEMS . . . . . Pg 64

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AEROQUIP SELF-SEALING COUPLINGS

AND FLEXIBLE HOSE LINES

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RAILROADS

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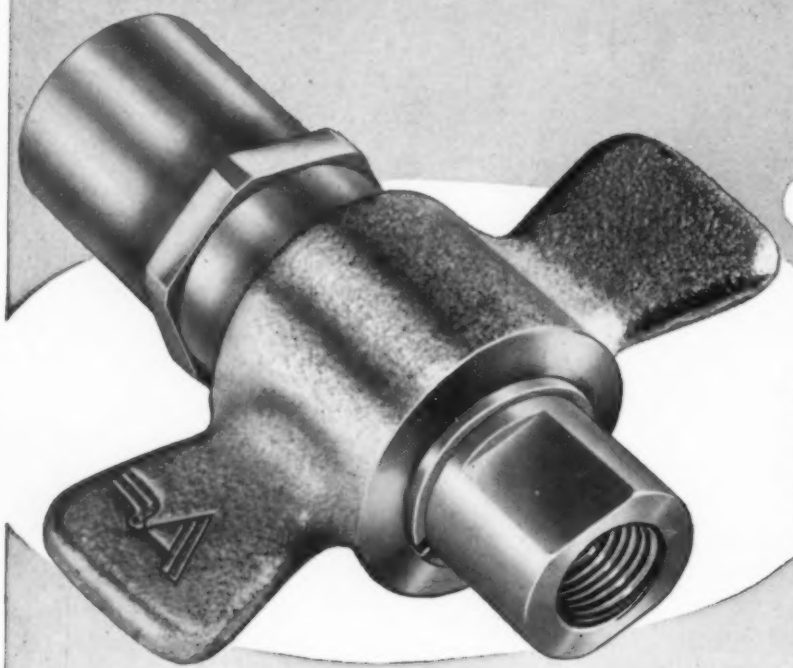
MATERIALS HANDLING TRUCKS

Speed Maintenance

WHEREVER FLUID-CARRYING LINES MUST BE DISCONNECTED AND RECONNECTED



Speed **maintenance,** ***speed*** **repair operations and** ***speed*** **interchanging of accessories joined by fluid-carrying lines with Aeroquip Self-Sealing Couplings. Lines may be separated in a few seconds without loss of fluid. No air enters the system upon reconnection. There is no need to drain or prime the fluid system. One Self-Sealing Coupling takes the place of two shut-off valves.**

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- ***Many modifications***—vacuum, air, and liquid service; various pressures; AC or DC solenoids; momentary contact

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ROSS Control VALVES

ROSS OPERATING VALVE COMPANY

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AUGUST, 1952
Vol. 5, No. 8

APPLIED HYDRAULICS

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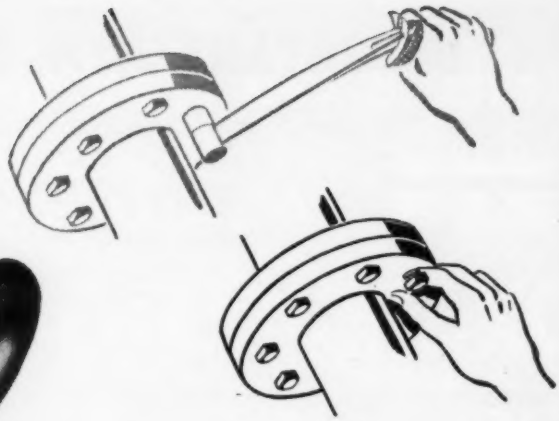
Results from designing for easier maintenance.....



1. Old Style
—with frequently replaced flat gasket.

2. New Style
—with permanent, leak-proof O-ring.

Why strain at bolts with a torque wrench when finger-tight pressure could do the job? Why not stop altogether the periodic checking and tightening necessary to compensate for the compression set of the usual flat gasket materials?

Using a LINEAR "O" ring gasket, you can achieve a perfect seal with metal-to-metal contact between flanges. And even better—that profit-eating overload designed into your line to compensate for the indeterminate sealing qualities of a flat gasket can be eliminated!

LINEAR "O" ring gaskets are easily installed without special assembly tools; further they cannot be unduly squeezed or damaged by over-tightening. Once installed they maintain a positive seal despite vibration or bolt stretch.

Take the guesswork out of the effectiveness of your flanged connections and standardize on one simple, efficient, maintenance-free method. Consult LINEAR for specific help with your sealing problems.

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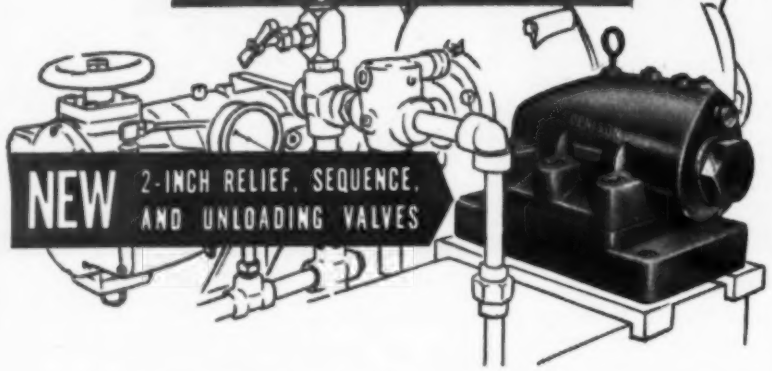
A line that continues to grow with

IMPORTANT *NEW* ITEMS

DENISON HydrOILics



New capacity for high volume circuits! The new two-inch HydrOILic Relief Valve is built for rugged, dependable pressure control up to 5000 psi, with volume capacities to 125 gpm. Like all HydrOILic Pressure Controls, they feature exceptionally low differential between opening and closing pressures — resulting in faster action . . . closer control of pressures . . . reduction of over-pressure and pressure-drop conditions. Subplate type mounting for high pressure circuits. Write for complete data.

NEW PRESSURE REDUCING VALVE

Now . . . *Denison quality* in a bigger-than-ever line of oil-hydraulic pressure controls! HydrOILic Reducing Valves provide independently adjustable pressures for secondary circuits, while main circuit operates at either constant or fluctuating higher pressures. Available in ¾", 1¼" and 1½" sizes, they permit secondary circuit volumes up to 65 gpm. Threaded, flange, or subplate mounting. Write for data.

Get *Denison* quality for all oil-hydraulic circuit needs. Specify HydrOILic Valves, Pumps, Fluid Motors, Pumping Units, Surge-Damping Controls, and the dual-purpose vane-type Pump/Motor featuring *complete radial balance* — for every circuit need. Write today!

The DENISON Engineering Co.

1166 Dublin Road Columbus 16, Ohio

LETTERS to the Editor

It is requested that this arsenal be furnished with three (3) copies of information on special low friction seals (Technical data sheet #102 on silocone "O" rings) at noted on page 44 of the December 1951 issue of APPLIED HYDRAULICS.

CHARLES E. BARRETT
Major Ord Corps
Assistant

The rings in question and the technical bulletin #102 are obtainable from the Frederick S. Bacon Laboratories, 192 Pleasant St., Watertown 72, Mass. We are sending you three copies of the notes on special low friction seals taken from the minutes of the last A-6 Aircraft Hydraulic and Pneumatic .Equipment Committee meeting.

Some months ago you ran a short article on a two stage hydraulic system which was controlled by a pressure switch in combination with a solenoid Can you give us the name of the author of this item?

LEWIS WELDING & ENGINEERING CORP.
Cleveland, O.

The author was Woodrow L. Wroble, the Wroble Engineering Co., 1067 Davis Terrace, Schenectady 3, N. Y.

Could you tell us if a complete set of articles entitled "Beginners Course in Basic Pneumatics", currently appearing in APPLIED HYDRAULICS is available? The writer will greatly appreciate more information on this series of articles since they have an active bearing on this type of work.

NORMAN D. SAWYER
Barkley & Dexter

The series "Beginners Course in Basic Pneumtics" is being especially prepared by APPLIED HYDRAULICS; currently it is being written two or three articles ahead of publication so that the entire series will not be available until after the installments have been completely published. However, due to the interest, plans are being made to republish the series in booklet form. The series will continue approximately two years.

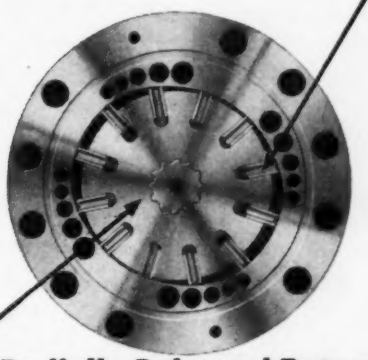
Continued on page 8

Today's Biggest Value in a Hydraulic Pump or Motor

"The Finest Money Can Buy!"

New Vane Design gives COMPLETE RADIAL BALANCE

Radially Balanced Vanes reduce vane load on the cam ring *regardless of operating pressures.* When system pressures increase, balanced vanes retain *low* loading characteristics for longer life.



Radially Balanced Rotor.
Opposed inlet and outlet porting provides complete radial hydraulic balance of the rotor.

The pumping cartridge, consisting of cam ring, rotor and vanes, operates with complete radially balanced action — assuring less wear on all moving parts.

A Size for Every Need!

Denison's new vane-type PUMP/MOTOR combines *radial hydraulic balance* with *fully interchangeable pump and fluid motor utility* — to bring you the finest that money can buy in compact power ever offered for 2000 psi continuous duty.

Available in four sizes with a choice of cam rings for each size, the Denison HydrOILic PUMP/MOTOR offers eleven different pumping capacities ranging from 2.7 to 70 gpm.

The same units are also *ready to operate* as fluid motors, without alterations of any kind. They offer 11 different torque capacities ranging from 13 to 257 pound-inches per 100 psi.

Think of the Advantages of These PUMP/MOTOR Features!

Balanced Vane Action. Rugged, specially designed vanes contact the cam ring with dual sealing edges. Complete radial balance assures minimum wear.

No Pulsation. Full, radial balance brings uniform delivery that reduces surge and pulsation to a minimum.

Interchangeable cam rings for each PUMP/MOTOR size widens the range of capacities for both pump and motor applications.

Versatility. Each PUMP/MOTOR is ready for use as either pump or fluid motor *without alterations of any kind* — for continuous duty at 2000 psi.

Bi-directional Rotation. All PUMP/MOTOR models instantly adaptable for either clockwise or counterclockwise operation without change or alteration.

DENISON HydrOILics

PUMP/MOTOR

The DENISON Engineering Co.
1166 Dublin Rd., Columbus 16, Ohio

WRITE TODAY FOR
PUMP/MOTOR Bulletin No. P-5

APPLIED HYDRAULICS

Fluid Power Lines

Light Weight Power Systems

One of the major advantages of hydraulic power in the ability of "packing a large force in a small package". Because of this, the engineers at Fairmont Railway Motors, Inc. selected oil power when designing their spike puller. The final machine is smaller and safer than any available mechanically actuated spike puller.

Uniform Surface Finishing

What's the "design thinking" behind a machine which will burnish bearing journals with uniform control of surface finish? Z. C. Van Schwartz describes the axle burnishing lathe built by the Niles Tool Works. The machine handles large, heavy railroad axles. Design of the hydraulic system provides simple adjustment of the finishing pressure to assure uniform finish on each land.

Timing Motions

How do you synchronize machine motions to produce uniform work and prevent interference between machine elements? There are of course many methods applied to machines which have more than two different movements. You may use cam controls, sequence valves, or electrical interlocks. Timing of a rotating cutter with extrusion speed is solved on the brick and tile cutting machine which is described in this issue. An electro-pneumatic system is used. Cam actuated air valves direct air to cylinders, which feed the material, and to brake and clutch cylinders that properly tie-in the electric drive which operates the cutting wires.

Servomechanisms

They're not as complicated as some of the textbooks make them look. You can tack "servomechanism" on to any device which changes its position to correct for a change in the load, speed or direction of the machine which it is controlling.

John Tietgen, Schweitzer Equipment Company's chief engineer, details the design of a servo system which keeps the speed of an oil driven paint spray cabinet in step with an electrically driven work carrying conveyor. Schweitzer calls the device a "proportionating" valve because it proportions the oil to the cabinet system according to conveyor speed. A simple mechanical linkage automatically "tells" the valve spool how to move. Commercial hydraulic components are used.

If you want to get involved deeper in servos, read part 1 of a 3 part article on "Powered Flying Controls" in the Aviation Section.

Reciprocating Fluid Motor

Paul Beacom's article on the pneumatic rollover mechanism describes one of the first applications of an air powered reciprocating fluid motor. This device is a single vane motor which is pneumatically reciprocated in an arc of 270 degrees. The motion is transmitted to a shaft integral to the vane. Driving this type of motor with oil has been done both in this country and in Europe for several years. The use of air has presented sealing problems which have only recently been solved.

Aircraft Pneumatics

Some of the practical developments in aircraft pneumatic systems on British planes are described in an article by H. R. Haerle. This month Mr. Haerle illustrates some of the compressor developments, discusses compressor cooling and lubrication, and pressure control. A typical system for a high speed trainer type craft is drawn and several aspects of a medium bomber system are discussed.

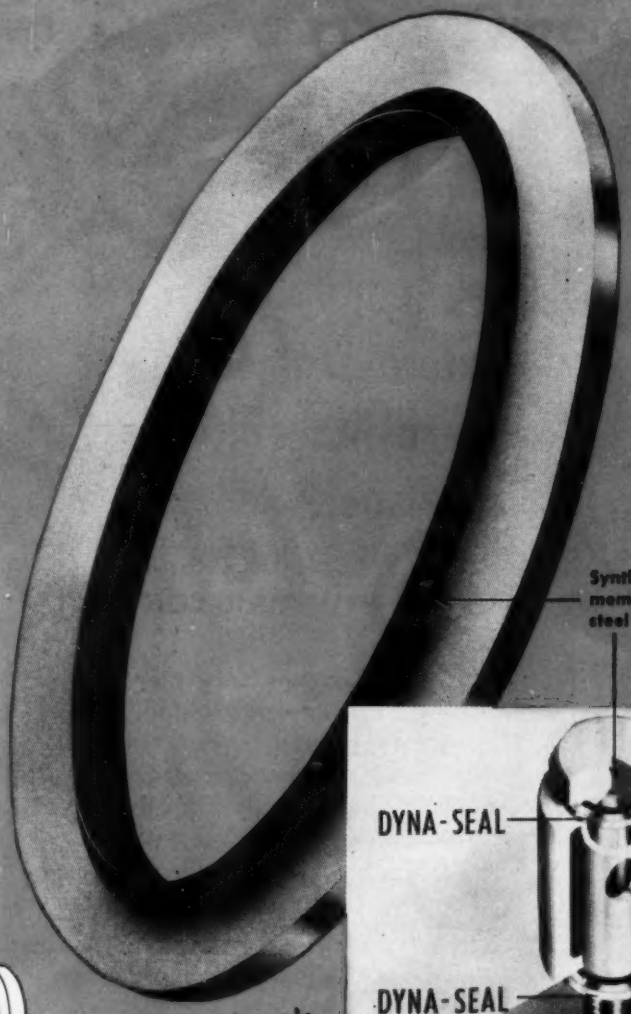
And In September . . .

. . . during the first week, is the National Conference on Industrial Hydraulics. The September APPLIED HYDRAULICS will have the complete program guide along with abstracts of papers directly related to oil hydraulics.

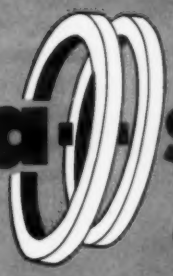
There will also be hydraulic design articles on a charging machine, a vertical slotter and a special molding press.

If you have been considering changing over to a nonflammable hydraulic fluid in your die cast shop or on machines being used in hot areas, you'll be interested in reading about the experience of Johnson Motors on their changeover in one of the largest die cast shops in the country.

PRP announces a New Product



...the Dyna-Seal*



thoroughly proved — a simple face-to-face seal!

*trademark registered
U.S. Patent 2,455,982

Synthetic rubber sealing member bonded to steel ring for sealing circular flat surfaces, bolt heads, rivet heads, flanges, special fittings — no grooves necessary. Seals all pressures against water, all types of petroleum products, many other fluids and gases. Countless applications. Write for free handbook.

The Name "Precision" in "O" Rings Is Like "Sterling" On Silver

Precision Rubber Products CORPORATION

The "O" Ring Specialists

Dept. 1, Oakridge Drive, Dayton 7, Ohio

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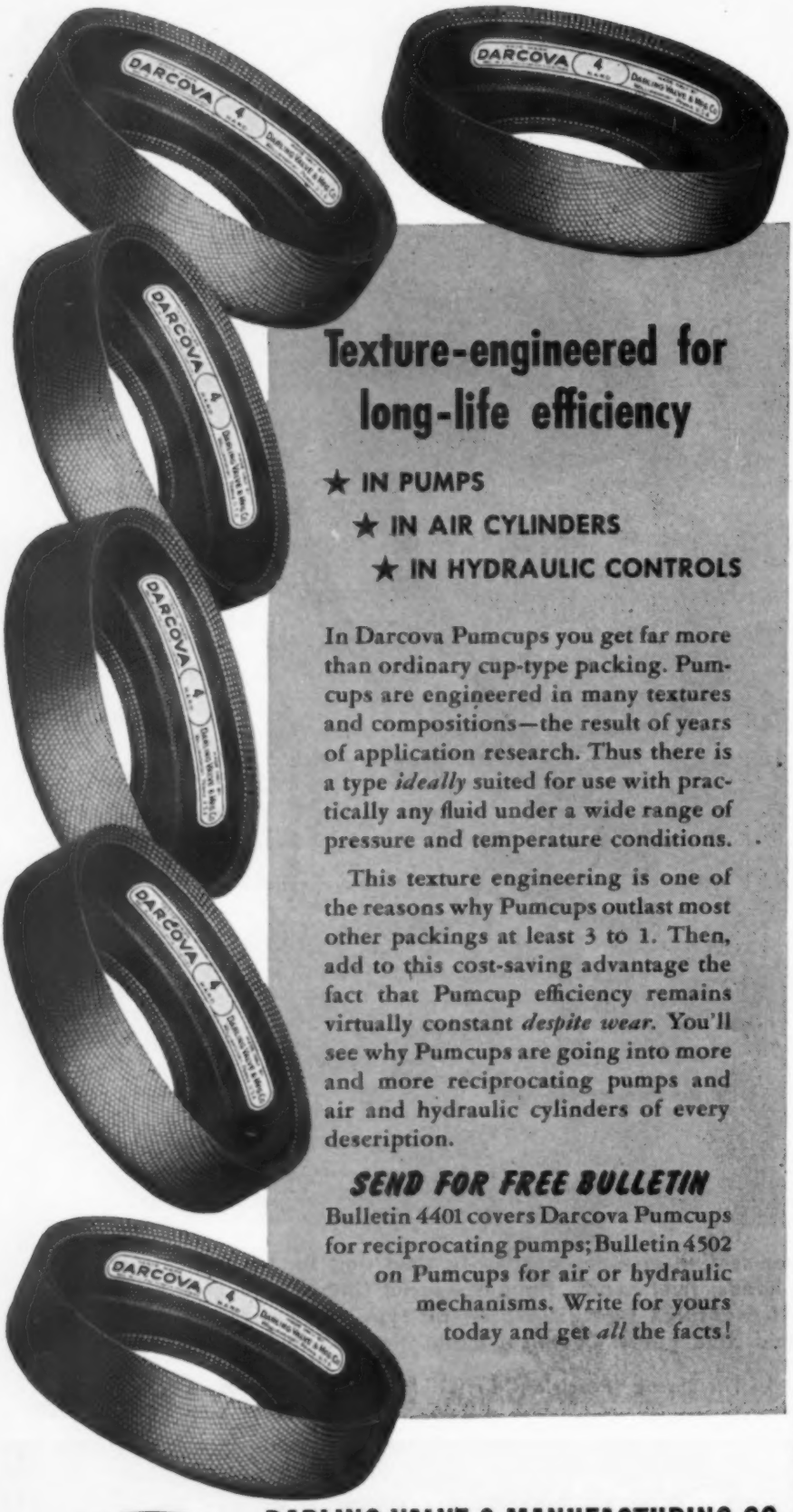


Texture-engineered for long-life efficiency

★ IN PUMPS
★ IN AIR CYLINDERS
★ IN HYDRAULIC CONTROLS

In Darcova Pumcups you get far more than ordinary cup-type packing. Pumcups are engineered in many textures and compositions—the result of years of application research. Thus there is a type *ideally* suited for use with practically any fluid under a wide range of pressure and temperature conditions.

This texture engineering is one of the reasons why Pumcups outlast most other packings at least 3 to 1. Then, add to this cost-saving advantage the fact that Pumcup efficiency remains virtually constant *despite wear*. You'll see why Pumcups are going into more and more reciprocating pumps and air and hydraulic cylinders of every description.

SEND FOR FREE BULLETIN

Bulletin 4401 covers Darcova Pumcups for reciprocating pumps; Bulletin 4502 on Pumcups for air or hydraulic mechanisms. Write for yours today and get *all* the facts!

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP

PUMCUPS

Letters to the Editor

Continued from page 4

We missed Part 1 "Air Properties and Characteristics" of the "Beginners Course in Basic Pneumatics" in your February issue. Will you send us a copy?

BRUNO MENEGUS
National Rubber Machinery Co.
Clifton Division

Tear sheets of part 1 of the "Beginners Course in Basic Pneumatics", published in the February 1952 issue of APPLIED HYDRAULICS have been sent to you.

Mr. Hastings and I were very pleased with the May issue in which our article, "Air in Hydraulic Systems" appeared. I should like to have additional copies for distribution to each of five oil suppliers, as some measure of appreciation of their help on many problems. There was one printing error, fourth paragraph, second line, item 3, page 57, should be *aim* not "air." As it may not be very easy for readers to guess what the correct word should be, do you think it might be worth while to print a correction note?

J. E. C. STRINGER
Vickers-Armstrongs Ltd.
Elswick Works,
Newcastle-Upon-Tyne

The extra copies have been sent to you. Your letter will serve as a correction note for the error.

We are interested in obtaining whatever articles or other sources of information you may have pertaining to methods or apparatus for measuring hydraulic pressure transients.

ROBERT E. RAYMOND
Sales Engineer
Simplex Engineering Co.

We are enclosing tearsheets to you of the article "Follow Oil Pressures with Electrons" which appeared in the January 1951 issue of APPLIED HYDRAULICS. Aeroquip Corporation and Electro Products Laboratories offer equipment for measuring hydraulic transients.

Please send me one copy of the 1952 APPLIED HYDRAULICS Data List and one copy of "Know Your Component Symbols".

A. F. FENGLER
Methods Engineer
Machlett Laboratories, Inc.

A copy of the Data List has been sent to you. Our present supply of the booklet "Know Your Component Symbols" has been exhausted. When the second printing is received, a copy will be sent to you.

Continued on page 23

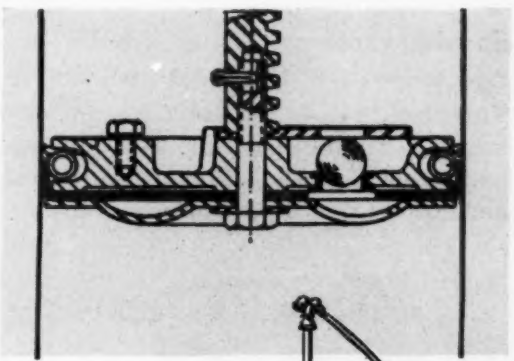
Are these two Cup Packings *Different*?

Yes... and HOW!

The leather cup packing on the left leaked gasoline. The *right* one *does not*.

A manufacturer of gallon stroke pumps for gasoline and oil dispensing employs a leather cup packing on the piston head as shown in the sectional drawing.

The ordinary cup leather did not deliver correct measure because of leakage through the leather. The complete pump assembly was shipped to G&K-INTERNATIONAL for suggestions. Because of the many thousands of pumps already in the field, redesign or improvement in the cup packing without change of the assembly was indicated.



and HOW! G&K-INTERNATIONAL developed a special leather treatment to completely prevent the passage of gasoline through the leather cup packing without changing its flexibility or other requisite characteristics. With these cups installed, the company now reports that the pumps deliver accurate measurement to their complete satisfaction.

Be sure you get the correct type of packing made from the proper components for your work! Send us complete specifications of your packings needs and G&K-INTERNATIONAL Engineers will help you solve your packings problems—before trouble starts.

second century G and K—INTERNATIONAL

GRATON AND KNIGHT ESTAB. 1851

Leather and synthetic packings

GRATON & KNIGHT COMPANY
Worcester 4, Mass.

INTERNATIONAL PACKINGS CORPORATION
Bristol, New Hampshire

← Circle 74 on Reader Service Card

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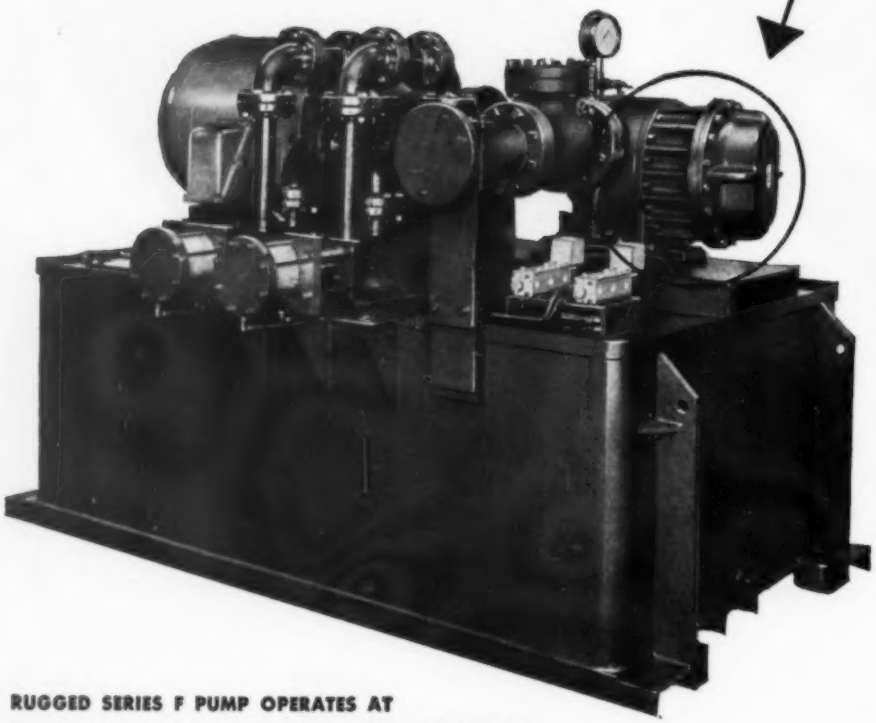
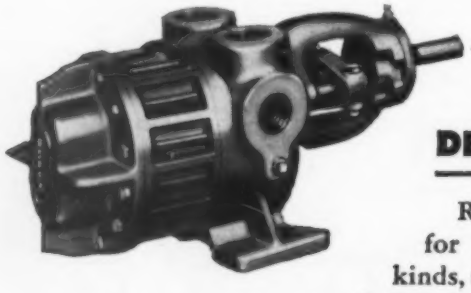
IT'S ROPER

for HEAVY DUTY Hydraulics



RUGGED SERIES F PUMP OPERATES AT 300 P.S.I. ON THIS STEEL MILL PILING EQUIPMENT

This power unit — used in conjunction with steel mill piling equipment — is a good example of Roper adaptability to heavy duty hydraulic applications. The unit is fabricated by the Weinman Pump and Supply Company of Pittsburgh, and the Roper used is a Series F.



DEPENDABILITY *Plus*

Roper Series F Pumps are used for pumping clean liquids of all kinds, and are self-lubricated by liquid being pumped. Four-port design (eight optional piping arrangements — 4 for C.W. and 4 for C.C.W. rotation) cuts installation time and costs. These pumps are supplied with or without relief valves — with packed box or mechanical seal. Pressures to 300 P.S.I. — 1-300 G.P.M. sizes.
Investigate how Ropers can fit into your hydraulic applications. Send for catalog.

SEE OUR CATALOG IN SWEET'S

GEO. D. ROPER CORPORATION
708 BLACKHAWK PARK AVE.
ROCKFORD, ILLINOIS

ROPER *Rotary Pumps*

LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

For more information circle numbers on the reader service card bound in this issue.

PURIFIERS PREVENT TROUBLE before it starts in hydraulic installations by keeping oil clean and free from damaging contamination. An 8 page hydraulic bulletin with case histories describing profitable advantages has been published by the Honan-Crane Corporation.

Circle 36 on Reader Service Card

FLEXIBILITY, SAFETY AND ECONOMY are the main features of ball bearing swivel joints which are outlined in Catalog 2A published by Chiksan Co.

Circle 11 on Reader Service Card

SOLENOID ACTUATED LEAKPROOF HOSE COUPLING, which can be actuated by electric, hydraulic or pneumatic controls is outlined in engineering and performance data, offered by E. B. Wiggins Oil Tool Co.

Circle 91 on Reader Service Card

WIDE TEMPERATURE RANGE can be covered by selecting the proper O-ring material. Plastic and Rubber Products Company offer catalog and engineering data to help avoid premature seal failures.

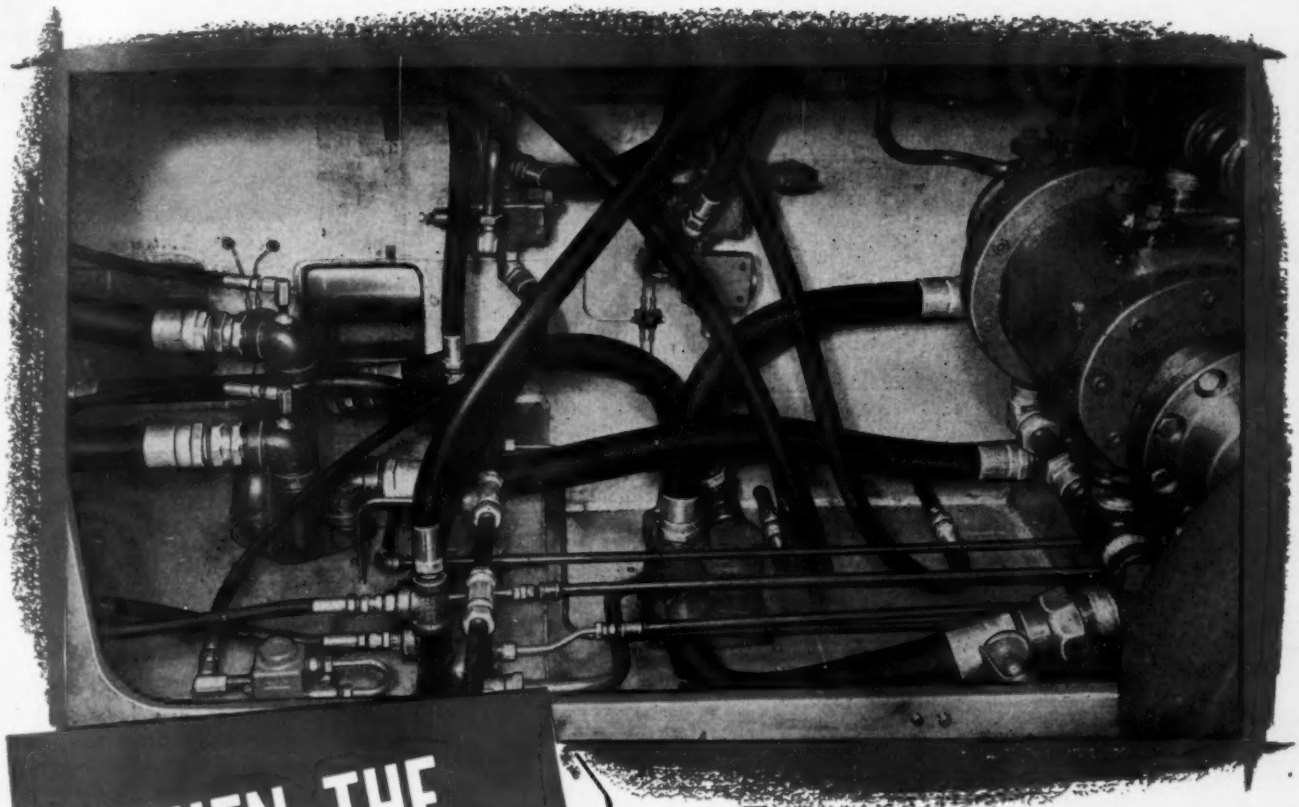
Circle 62 on Reader Service Card

HIGH QUALITY large capacity reducing valve with safety relief, and an efficient air filter are combined in a single compact unit. Available in a variety of ranges Bulletin FH 15, offered by the Conoflow Corp. gives full details.

Circle 13 on Reader Service Card

TROUBLE-FREE SERVICE LIFE is obtained from gear type hydraulic pumps which are pressure loaded. Complete specification and performance chart is offered by Pesco Products Division of Borg-Warner Corp.

Circle 60 on Reader Service Card



WHEN THE PRESSURE'S ON

ANCHOR Hose and Ductile Sleeve Couplings handle it

easily, efficiently, safely

EXTRA safety, unusual dependability — that's what the manufacturer of this 25-ton 66" Double Ram wanted. And that's why he specified Anchor Ductile Sleeve Couplings and Hose. Like many other manufacturers of machinery using hydraulic systems, he knows Anchor's exclusive patented grip makes the coupling virtually a part of the steel reinforcing wire of the hose — eliminates leaks and troublesome blow-offs.

HERE ARE ADDITIONAL REASONS why Anchor two-wire braid high-pressure hose assemblies were selected for this tough job:

- ☆ They reduce maintenance and service on piping to practically nothing.
- ☆ They are unusually easy to install — save fitting time, cut assembly costs.
- ☆ They provide maximum operating efficiency.

Anchor also makes a complete line of adapter unions and related fittings for practically every pressure or suction job. Take advantage of the many outstanding features in the most complete line of hose assemblies and fittings available. Benefit by the plus margin of safety and the greater dependability offered by Anchor.

Attach Coupon to Your Letterhead and Mail Today

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ANCHOR COUPLING CO. INC., Dept. AH-82
Libertyville, Illinois

Yes. I'm interested in Anchor Ductile Sleeve Hose Assemblies and Fittings. Send me catalog sheets.

Name..... Position.....

Company.....

Company Address.....

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D-12

Specially Compounded For Both New Equipment and Maintenance Installations

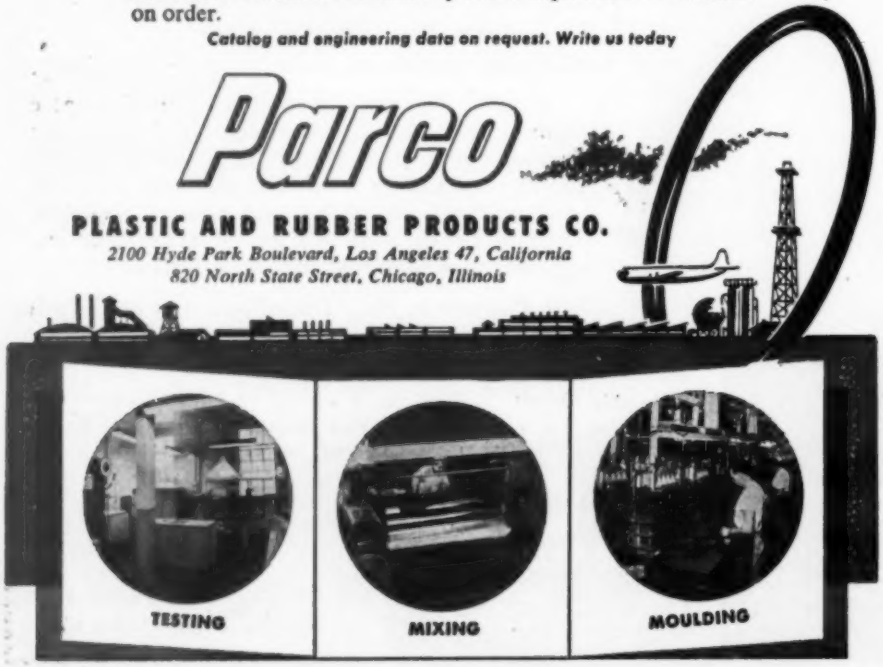
In the drilling, refinery or pipeline operation on both new equipment and maintenance work, specially compounded Parco "O" Rings do the job better. Parco "O" Rings are rubber combinations blended to meet your specifications and molded to tolerances that make them superior seals for both static and dynamic use. For your assurance and best protection of smoother running and longer wearing hydraulic seals, insist on Parco. Other Parco rubber products used in the oil industry meet the same high standards of Parco "O" Ring quality Specify a superior product at no premium to you. All dash numbers of 6227, 6230 and 6290 series for commercial applications or Army-Navy installations to Specifications MIL-P-5516 (6227 and 6230) and MIL-G-5510 (6290) are available from stock. Silastics and other special compounds are available on order.

Catalog and engineering data on request. Write us today

Parco

PLASTIC AND RUBBER PRODUCTS CO.

2100 Hyde Park Boulevard, Los Angeles 47, California
820 North State Street, Chicago, Illinois



ADJUSTABLE FLOW REGULATOR which permits free return flow, is illustrated in a circular prepared by the Waterman Engineering Co.

Circle 87 on Reader Service Card

AUTOMATICALLY REGRINDING its own surfaces is a hydraulic valve detailed in Bulletin H 210 issued by the Yarnall Waring Co. The Bulletin tabulates types and sizes.

Circle 92 on Reader Service Card

DRY-SEAL THREAD PRESSURE PLUGS are illustrated in literature issued by the Standard Pressed Steel Co. which gives a full range of available sizes.

Circle 73 on Reader Service Card

FASTER INSTALLATION, faster servicing, less labor and materials and less pressure drop are the advantages of flareless fittings which are described in Catalog E 1457, available from The Weatherhead Co.

Circle 88 on Reader Service Card

ALL TYPES OF HYDRAULIC VALVES for power applications are outlined in a new catalog available from the Superdraulic Corporation.

Circle 75 on Reader Service Card

DURABILITY AND COMPACTNESS are the main features of the RH series cylinders, available in capacities to 3000 psi for special applications. Pathon Manufacturing Co. describes these cylinders in Bulletin #17.

Circle 58 on Reader Service Card

FOR HEAVY DUTY APPLICATIONS, pumps with or without relief valves and with packed box or mechanical seal are described in a catalog offered by Geo. D. Roper Corporation.

Circle 65 on Reader Service Card

PRECISION CONSTRUCTED air and hydraulic cylinders, furnished with cartridge type packing glands are outlined in engineering data prepared by Petch Manufacturing Co.

Circle 61 on Reader Service Card

Conestoga Wagons had POWER STEERING... Why not Modern Trucks?

Thousands of these sturdy wide-wheel wagons carried freight between the Atlantic Coast and Pittsburgh, the gateway to the "Ohio country", in the 1830's and 40's. The driver rode the left wheel horse and did not steer by muscle power. He signalled the left lead horse with a single rein . . . shouted "gee" and "haw". If a wheel hit an obstruction or a softer spot than usual, the horsepower took care of it . . . not the driver's back and shoulders. Flat tire trouble was eliminated by having them all flat (iron) in the first place.

The ordinary modern motor truck is far superior to the Conestoga in every way except steering. In eliminating the 6-horse teams with jingling bells, we have loaded the work of steering on the driver himself. Without power steering he has to expend physical effort that at times would have daunted even the rough and ready Conestoga men. Drivers tire, slow down, become less efficient . . . more prone to have accidents.

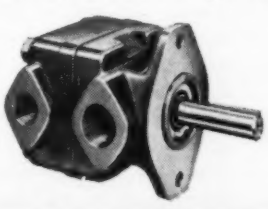
When equipped with Vickers Hydraulic Power Steering, the heaviest truck can be steered under even the most adverse conditions (ruts, soft shoulders, flat tires, etc.) with only a light finger touch on the steering wheel. Drivers remain fresh, efficient, safe. Get additional information by asking for Bulletin M-5100.

VICKERS Incorporated

DIVISION OF THE SPERRY CORPORATION

1474 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices: **ATLANTA • CHICAGO (Metropolitan) CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES (Metropolitan) NEW YORK (Metropolitan) • PHILADELPHIA • PITTSBURGH • ROCHESTER ROCKFORD • ST. LOUIS • SEATTLE • TULSA • WASHINGTON • WORCESTER**



VICKERS hydraulic POWER STEERING

Is Effortless, Positive and Shockless

4700

UNAFFECTED BY ANY HYDRAULIC FLUID, chemiseal packings won't harden, soften, swell or shrink in service. These packings are described in Catalog No. 810-V published by the U. S. Gasket Co.

Circle 83 on Reader Service Card

LONG LIFE EFFICIENCY in pumps, air cylinders and hydraulic controls is obtainable with cup type packings designed for use under a wide range of pressure and temperature condition. Darling Valve Mfg. Co. has prepared Bulletin 4401 covering pumpcups for reciprocating pumps and Bulletin 4502 on pumpcups for air and hydraulic mechanisms.

Circle 15 on Reader Service Card

ACCURATE MEASUREMENT of acceleration or motion by use of a new impulse generator is described in Bulletin MP 552 available from Electro Products Laboratories.

Circle 22 on Reader Service Card

Versatile, Portable Power with The Superior Hydraulic Tube

Illustrated above is a new, versatile, light-weight hydraulic power unit, designed and built by The Hydraulic Service Company of Cheltenham, Pennsylvania . . . and a Superior Hydraulic Tube that helps speed its production.

The unit is unique among its kind. It is entirely self-contained, except for the motor. It weighs little yet delivers any pressure desired up to 2,000 psi. It is tough, long-lived, economical to maintain and operate . . . it is in fact a machine of quality.

That's why Hydraulic Service selected Superior Hydraulic Quality low carbon steel tubing for its new unit. They know from experience that Superior delivers tubing that bends better, flares better, stands up better on the job . . . and is always uniform in property . . . precise in dimension . . . exact in analysis.

If you use Hydraulic Tubing and your application demands the best—check with Superior. Write today for free literature, complete information and the name of the Superior Distributor nearest you. Superior Tube Company, 2030 Germantown Ave., Norristown, Pennsylvania.

Superior

THE BIG NAME IN SMALL TUBING

All analyses .010 to ⅝" O.D.
Certain analyses (.035" max. wall) up to 1⅜" O.D.

Circle 76 on Reader Service Card

AIR CONTROL VALVE which is solenoid operated and shows many quality features is described in Bulletin A-8 available from the Valvair Corp.

Circle 85 on Reader Service Card

CONTROL VALVES for long wear and leakfree service are detailed in Catalog 552 issued by the W. H. Nicholson Co.

Circle 52 on Reader Service Card

HYDRAULIC EQUIPMENT which permits application of forces up to 100 tons in any direction simultaneously is discussed in Bulletin 150 available from the Hannifin Corp.

Circle 33 on Reader Service Card

WITHSTAND HIGH TEMPERATURES and pressures, without scoring or abrading by using leather packings manufactured by J. E. Rhoads & Sons. Tannate leather packing folder describing all features can be obtained.

Circle 64 on Reader Service Card

ADVANTAGES of a new vane type pump motor, manufactured by the Denison Engineering Co., are illustrated in pumpmotor Bulletin No. P-5.

Circle 17 on Reader Service Card

INJECTION MOLDED O-RINGS which function in hydraulic cylinders, hydraulic valves, air cylinders and lubricators, motors and many others, have been described in an O-ring catalog published by the Minnesota Rubber and Gasket Co.

Circle 49 on Reader Service Card

TIME SAVING OPERATION of hydraulic equipment can be achieved by ¾" multiple section valve, operating any number of cylinders or fluid motors simultaneously under full or varying load. Informative data Bulletin No. 3104 describing this new development is available from Sundstrand Machine Tool Co.

Circle 74 on Reader Service Card

TO SAVE TROUBLE and time in the selection of pumps best suited to your need, Tuthill Pump Co. has issued a guide showing performance characteristics and other distinctive features.

Circle 80 on Reader Service Card

Letters to the Editor

Continued from page 8

On page 112 of the May issue of APPLIED HYDRAULICS is shown an air release valve incorporating a metering device which ejects air at each operation of the hydraulic system. Can you tell me where I can obtain more engineering literature on such a device and whether or not such a device is commercially available?

M. M. SEELOFF
The Taylor-Winfield Corp.
Chief Engineer

The air release valve incorporating a metering device, shown on page 112 of the May issue is made by Vickers-Armstrongs, Ltd. We suggest you write to the author Mr. J. E. C. Stringer, Vickers-Armstrongs, Ltd., Elswick Works, Newcastle-Upon-Tyne, England, regarding the availability of this valve

---

Can you tell us if there is available an "O" ring with either a Kel-F or Teflon coating? We have a laboratory application for which we believe such rings may be a solution.

WILLIAM W. LYTLE
Lytle Engineering Co.

The Shambon Company, 2363 E. 38th St., Los Angeles 58, Calif., offers a silicon "O" ring with a Kel-F coating.

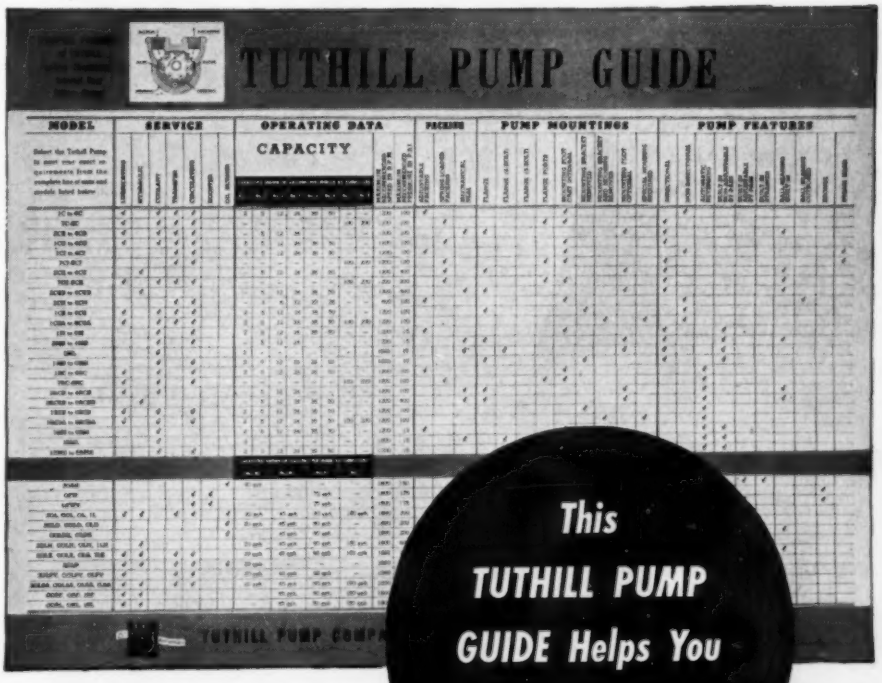
As a reader of your magazine APPLIED HYDRAULICS we should be pleased if you could supply us with literature about J. I. C. hydraulic symbols.

"SVENDARED" N.V.
Technische Hendelsmaatschappij
Rotterdam, The Netherlands

The J.I.C. hydraulic symbols are an integral part of the J.I.C. Hydraulic Standards for Industrial Equipment. Issued originally in 1948 under the sponsorship of major automotive users of hydraulic equipment, the Standards have been widely accepted in American industry. The hydraulic symbols, since they indicate flow patterns, are simple and easy to understand, are steadily gaining in favor with personnel that operates and maintains hydraulic equipment and circuits as well as with the manufacturers of hydraulic components and systems. A reprint of a series of component symbols, "Know Your Component Symbols", for example, proved very popular with our readers. A first printing has been exhausted; a second, larger reprinting is now on the press. A copy will be sent you when available.

Continued on page 27

NEW EASY WAY TO SELECT THE RIGHT PUMP FOR THE JOB



This TUTHILL PUMP GUIDE Helps You Find the Answer

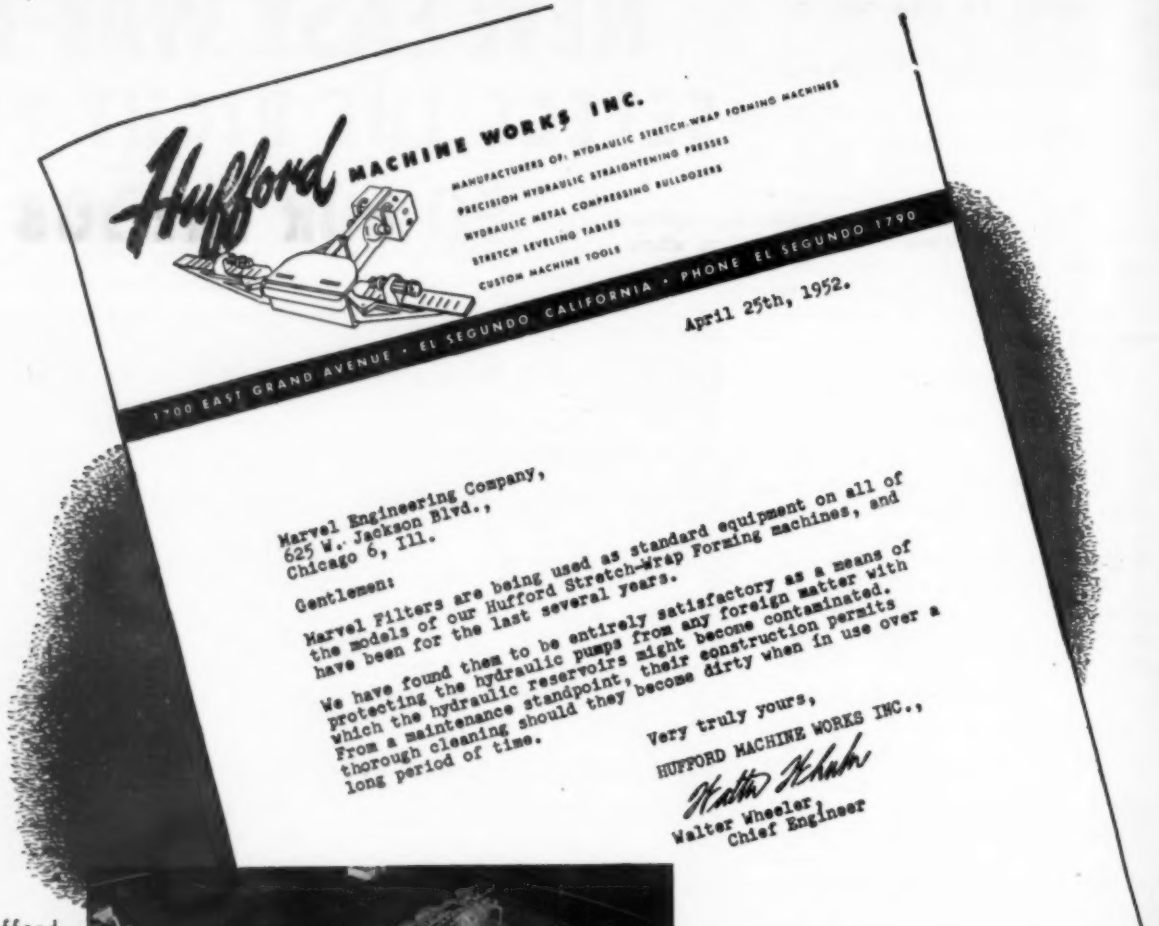
To save you time and trouble in selecting the pump best-suited to your application, Tuthill engineers have developed this revolutionary new Pump Guide. Here, in one easy-to-use chart, is a volume-full of information on the complete line of Tuthill Pumps.

At a glance, it shows you the services for which each model is built, together with performance characteristics, types of packing, mounting styles and distinctive features that enable you to fit the pump to your need, rather than the need to the pump.

Copies of this helpful guide are now available on request. Write for yours today—there's no obligation.

Tuthill Positive Displacement Pumps serve Industry in Lubrication, Hydraulic, Coolant, Oil Burning, Circulating and Transfer Service.

25th Anniversary TUTHILL PUMP COMPANY
939 East 95th Street . . . Chicago 19, Illinois



Hufford MACHINE WORKS INC.

MANUFACTURERS OF: HYDRAULIC STRETCH-WRAP FORMING MACHINES
PRECISION HYDRAULIC STRAIGHTENING PRESSES
HYDRAULIC METAL COMPRESSING BULLDOZERS
STRETCH LEVELING TABLES
CUSTOM MACHINE TOOLS

1700 EAST GRAND AVENUE • EL SEGUNDO CALIFORNIA • PHONE EL SEGUNDO 1790

April 25th, 1952.

Marvel Engineering Company,
625 W. Jackson Blvd.,
Chicago 6, Ill.

Gentlemen:

Marvel Filters are being used as standard equipment on all of the models of our Hufford Stretch-Wrap Forming machines, and have been for the last several years.

We have found them to be entirely satisfactory as a means of protecting the hydraulic pumps from any foreign matter with which the hydraulic reservoirs might become contaminated. From a maintenance standpoint, their construction permits thorough cleaning should they become dirty when in use over a long period of time.

Very truly yours,
HUFFORD MACHINE WORKS INC.,
Walter Wheeler
Chief Engineer

Model A-12 Hufford Stretch-Wrap Forming Machine. Used for forming extruded shapes, handles work from 208" to 304" long. Will also form sheets up to 20" wide. One of 9 models of this type produced by Hufford. Marvel Synclinal Filters are installed by the manufacturer as standard equipment to protect the hydraulic systems and other specialized machines produced by this company.

Photo Courtesy Consolidated Vultee Aircraft Corp., San Diego Calif.

FOR ALL HYDRAULIC AND LOW PRESSURE SYSTEMS

Sump Type (cutaway) — Line Type (cutaway)

Marvel filters are available in sump and line type models, in capacities from 5 to 100 g.p.m. and in monel mesh sizes from 30 to 200. Both types may be easily disassembled, cleaned and reassembled by any workman. Line types operate in any position and may be serviced without disturbing pipe connections. For efficient filtration of non-corrosive liquids investigate Marvel Synclinal Filters.

WATER FILTERS In response to the great demand, we have adapted both our sump and line types for use in all water filtering applications. No changes have been made in the basic Synclinal design.

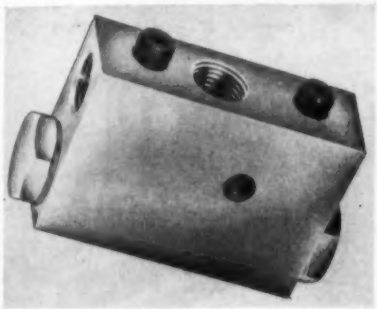
Write for Complete Engineering Data Specify Oil or Water

Meets J.I.C. Standards

MARVEL ENGINEERING COMPANY
625 W. Jackson Blvd. Chicago 6, Ill.

What's NEW in Components for fluid power systems

For more information about these products use the postcard bound in this issue

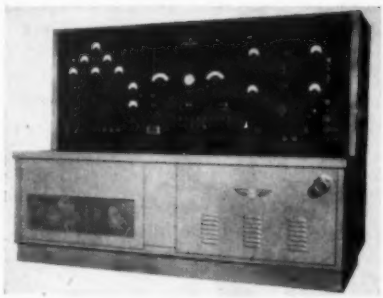


Pilot Check Valve

Fluid Controls, Inc.
Willoughby, Ohio

Sizes: ¼ in. and ⅜ in. pipe size.
Design: The valve utilizes a ball check seating on a hardened steel seat. The pilot piston has four times the area of the check seat, reducing the pilot pressure required to open the valve.
Application: This valve is desiged for long trouble-free life on hydraulic clamps, lift trucks, and machine tools. It is used whenever it is necessary to lock a cylinder without leakage.

Circle 151 on Reader Service Card

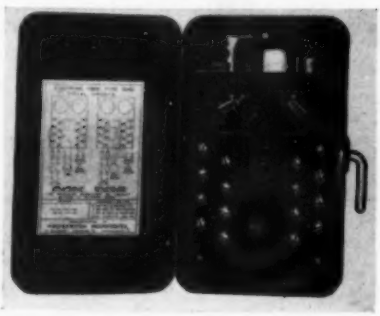


Test Stand

Greer Hydraulics, Inc.
Brooklyn, N. Y.

Design: The EL-100 is equipped with a three phase balance load bank to test inverters and alternators, a direct current load bank to test generators and the necessary test circuits to check the operation of voltage and current regulators, control relays, flashers, circuit breakers, etc.
Application: For a universal type of test machine for electrical power generating components as well as the power control components of the modern day airplane.

Circle 152 on Reader Service Card



Electronic Timer

Photoswitch Inc.
Cambridge, Mass.

Designation: Type 30HL1
Application: For process control, machine timing and other industrial applications where long life repeat cycle operation or precise accuracy is a prerequisite.
Operation: Type 30HL1 is an automatic timer for intervals from 1/20 second to four minutes. It provides four basic types of timing: interval, delayed action, automatic repeat and programming, as well as many variations of these four fundamental types.

Circle 153 on Reader Service Card

Time Delay Switch

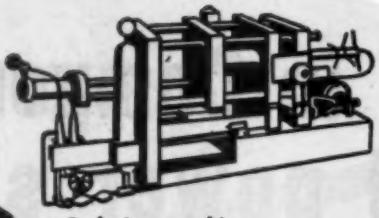
Pneu-Trol Devices, Inc.
Chicago, Illinois

Rating: Furnished to dwell in any 20 to 1 ratio from a minimum of ¼ second to a maximum of 60 seconds.
Design: Provided with a wide variety of thrust linkages for either right or left down thrust, upthrust or horizontal thrust actuation. Changing of the liquid viscosity in the dashpot provides variation in the dwell ratios. Time delay adjustments within the 20 to 1 ratio are quickly made by turning the knurled adjusting screw on the switch housing. The switch is also available in explosion proof and vapor sealed types.
Application: Widens the use of air and hydraulic cylinder power in controlling machine movements by providing controlled time dwell at positive stops on either end of the cylinder movement.

Circle 154 on Reader Service Card

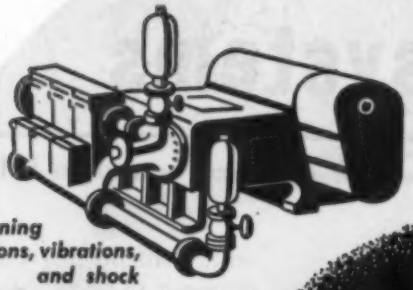
For more new product information turn to page 78

Many PROBLEMS One SOLUTION



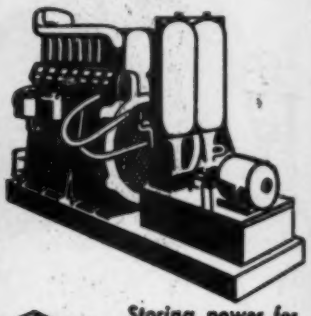
Reducing machine floor space and operating cost

Saving labor by remote control operation



Dampening pulsations, vibrations, and shock

Holding work securely for long periods



Storing power for starting engines

Reducing size, cost, and power requirements of machinery

Magnifying power for intermittent duty systems

Furnishing emergency power when pumps fail

Above are but a few of the hundreds of valuable functions performed by Greer Accumulators. Greer Bulletin 301 is packed with data, diagrams, and illustrations showing how Greer Accumulators have increased the efficiency and dependability and reduced the cost of various types of power-driven equipment. Send now for your free copy.

GREER HYDRAULICS, INC.

456 Eighteenth Street, Brooklyn 15, N.Y.

Sales Representatives in Principal Cities
District Office: 407 So. Dearborn St., Chicago 5

GREER
ACCUMULATORS

LICENSED UNDER GREER OLAER PATENTS

Letters to the Editor

Continued from page 23

We have a hydraulic machine to build at the present time which will operate at pressures up to 2500 psi; and one circuit requires 2 inch IPS runs, one other 1¼ inch and the third ¾ inch runs. We have found it very difficult to obtain any accurate, condensed tabular information covering the specifications of and strengths, types and manufacturers of suitable seamless pipe, tubing or fittings that will do this job. Do you have this information available or can you tell us where we can obtain this information?

A. L. SENN, JR.
Ass't Chief Engineer
Colby Steel & Mfg. Inc.

Several manufacturers publish tables that will be useful. The Aldrich Pump Company has a rather complete set in their Hydraulics Handbook, Bulletin No. 50; The Parker Appliance Co. have a very useful set of charts and tables in their Tube Fitters' Manual (Handbook No. 111); Superior Tube Company publishes data of a similar type and the Oilgear Company publishes Bulletins 90010, "Determining Pressure Drop and Power Losses" and 90011, "Piping Recommendations". These are representative of data available from leading manufacturers. For additional data check with other manufacturers or their representatives. See classifications Fittings, Tube; Fittings, Pipe; Pipe, Steel and Seamless Steel and Tubing, Steel in APPLIED HYDRAULICS Directory (January 1952 issue).

Will you please send to the undersigned one copy of your booklet "Know Your Component Symbols".

J. I. COLE
Plant Superintendent
McFarland Manufacturing Corp.

We are sorry but the first printing has been exhausted. A second larger printing has been ordered and copies will be available in a few weeks. EDITOR'S NOTE: We have had a very heavy demand for this booklet and have a number of unfilled requests on hand. Copies will be forwarded as soon as possible.

We are interested in rebuilding a wheel press which is identical to that described in your article "Smoothing Out a Pressing Problem" published in the May 1949 issue of APPLIED HYDRAULICS. Would it be possible to send us a copy of this article?

R. H. HERMAN
Engineer, Shops and Equipment
Southern Railway System
Washington 13, D. C.
Tearsheets have been sent.

This is it!
The Electrol
CHECK VALVE
That Prevents Reversal
of Flow in
AIR... OIL
OR WATER
APPLICATIONS
The Electrol (463FP) Check Valve is ideally suited for heavy-duty service applications — providing air, oil or water control lines with a minimum of pressure drop, and positive sealing against return flow. It has a maximum operating pressure of 5000 P. S. I., with a cracking pressure—in free flow direction—from 2 to 8 P. S. I. Elements are of brass and bronze—and include a patented O-ring check seat. Let us have a blueprint so we can work with you in adapting this Check Valve to meet your specific requirement. Your inquiry will receive prompt attention.
Better Designed Products Use Electrol Hydraulics
Electrol
INCORPORATED
HYDRAULICS
KINGSTON, NEW-YORK
CYLINDERS • SELECTOR VALVES • FOLLOW-UP VALVES
CHECK VALVES • RELIEF VALVES • HAND PUMPS
POWERPAKS • LANDING GEAR OLEOS • SOLENOID
VALVES • ON-OFF VALVES • SERVO CYLINDERS • TRANSFER
VALVES • CUT-OUT VALVES • SPEED CONTROL VALVES

SAVE TIME—CUT COSTS!

with PEMACO

Air and Hydraulic Cylinders

Furnished with Cartridge Type Packing Glands
Designed in accordance with J.I.C. Standards to

PUSH—PULL—PRESS—LIFT

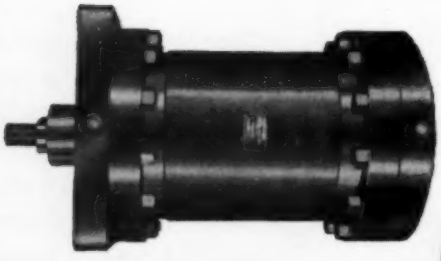
PEMACO Cylinders are equipped with the new PEMACO "EASY-PAK" Cartridge Type Glands.

PEMACO Air and Hydraulic Cylinders are soundly engineered—precision constructed with the most modern equipment. All parts are completely tooled for interchangeability. Steel rams are hardened to 50.C Rockwell, ground and lapped . . . bore sizes range from 2" to 8". Eight different types of mountings: Foot, blind end flange, rod end flange, clevis, trunnion, rabbet, manifold, centerline, are available as standard and any combination may be had.

PETCH MANUFACTURING COMPANY is equipped to design and manufacture special cylinders in large or small lots to suit your requirements . . . ready and able to show how you can improve your operations and lower costs with precision built PEMACO Air and Hydraulic Cylinders. Our Engineering Department is at your service on any special application. Field Engineers are located throughout the United States in Industrial Centers.

Manifold Mounting

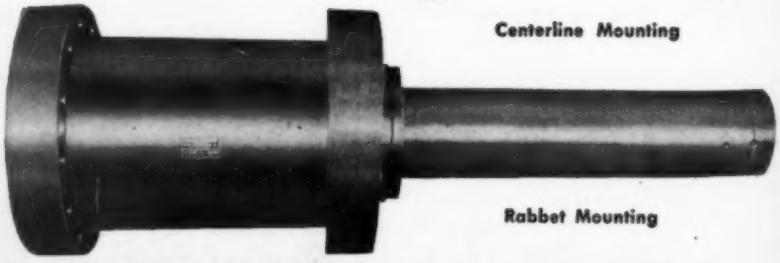
Trunnion Mounting



Rod End Flange Mounting

Blind End Mounting

Centerline Mounting



Rabbet Mounting

Write now for complete information and engineering data.

PETCH MANUFACTURING COMPANY

36100 HARPER AVE. MT. CLEMENS, MICH.

"Now you can clean hydraulic systems without interrupting production!"

Shell has developed a unique method of cleaning and dehydrating all classes of hydraulic systems. The Shell Cleaning Method does the job quickly and thoroughly . . . without wasting valuable production time. These are the highlights:

It's thorough . . .

This tested method employs a special oil that can do a multiple cleaning job while your machines operate during a regular production shift.

It dehydrates . . . removes sludge . . .

The special cleaning oil will materially dehydrate wet sludges in a system and remove them . . . at the same time it has high solvency for products of oxidation. It coats critical surfaces with an effective rust preventive so that no part of the mechanism is unprotected while the cleaning oil is drained from the unit.

It costs little . . .

The cost of using the Shell Cleaning Method is surprisingly low, since no expensive material nor equipment is required.

". . . and when it's clean . . . fill it with Shell's Improved Tellus Oil"

This is the one inhibited oil that:

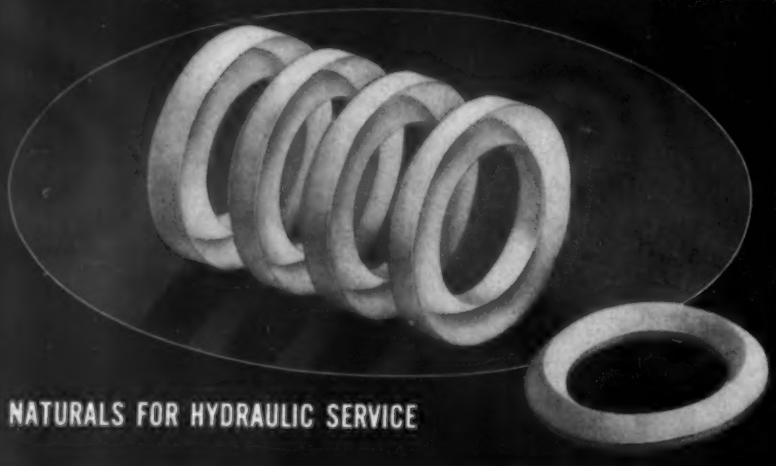
1. **Prevents Rusting . . . with a new combination of rust inhibitors . . . licks the rust problem for good.**
2. **Reduces Foaming . . . even with minor air leaks in the system.**
3. **Excels in Oxidation Stability . . . prevents sludging and emulsion formation.**
4. **Prevents wear . . . maintains tenacious film of great strength at all times.**

SHELL OIL COMPANY
50 West 50th Street, New York 20, N. Y.,
or 100 Bush Street, San Francisco 6, Cal.

SHELL

SHELL HYDRAULIC OILS

CHEMISEAL (MADE OF TEFLON) PACKINGS



NATURALS FOR HYDRAULIC SERVICE

Unaffected by any hydraulic fluid, Chemiseal Packings—made of chemically inert Teflon*—won't harden, soften, swell or shrink in service. Outlast other type packings several times over.

FOR HYDRAULIC VALVES

Try Chemiseal V-Type Packings that seal with low gland pressures and operating torque. Extremely resilient, tough, anti-hesive—it cannot seize the valve stem, is ideal for either manual or automatically operated valves.

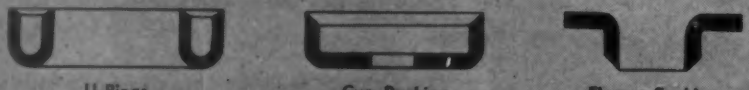
Supplied in sets with square-end Teflon adaptors. Ask for Catalog No. 810-V.

CHEMISEAL BACK-UP RINGS

Protect O-Rings and other packing from extrusion, deterioration and loss of efficiency with Chemiseal Back-up Rings.

They support packing and greatly lengthen its life.

OTHER CHEMISEAL PACKINGS



U-Rings | Cup Packing | Flange Packing

UNITED STATES GASKET COMPANY

FLUOROCARBON PRODUCTS DIVISION

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*du Pont's trademark for its tetrafluoroethylene resin.

Additional Speakers Announced by National Conference on Industrial Hydraulics

A NUMBER of additional speakers have been announced for the eighth annual meeting of the National Conference on Industrial Hydraulics, which will be held on Thursday and Friday, September 4 and 5 at the Sherman Hotel, Chicago. As previously announced, the NCIH this year will be a part of the Centennial of Engineering, marking the 100th anniversary of the founding of the American Society of Civil Engineers.

Mr. George Franck, The Imperial Brass Manufacturing Co., will give a paper at the accessories section on "Portable Tube Working Tools". Other additions and changes noted are those in addition to or different from the partial program announced in the July issue of APPLIED HYDRAULICS, pages 40, 42 and 44.

Speaks on Aircraft Systems

Leo Chattler, Bureau of Aeronautics, Navy Department, will speak at the aviation session on "Design for Increased Reliability of Aircraft Hydraulic Systems". This also completes the speakers for this session.

P. W. Seewer, The English Electric Company, Ltd., will speak on "Anti-Racing Hydro-Brake for Adjustable Blade Propellers and Propeller Turbines" at the hydro power session.

T. J. Linder, chief engineer, Hydraulic Press Manufacturing Co. will speak in the hydraulic press session on the subject "Double Action Hydraulic Press Circuits". This is a change from a previously announced speaker.

At the machine tool session the previously announced paper on "Air Powered Hydraulics" will be given in two parts with Paul Butzin, chief engineer, Delta Power Tool Div., Rockwell Manufacturing Co., sharing the delivery with Clarence Johnson, design engineer.

The luncheon speakers have been announced. For the luncheon on Thursday, R. C. Binder, professor of mechanical engineering, Purdue University, will speak on "Educating the Hydraulic Engineer". On Friday, the luncheon guests will hear Dr. J. T. Rettaliata, the new

president of Illinois Institute of Technology, on "Cooperating with Industry."

Conference Registration

Frank W. Edwards, general manager of the Centennial of Engineering, will act as toastmaster for the All Societies banquet on Thursday evening. The speaker for the banquet and members of the panels for various sessions will be announced later.

Since the largest attendance in the history of NCIH is anticipated, it is suggested that those who expect to attend make their Conference and hotel reservations as soon as possible. For Conference registration write to John G. Duba, NCIH secretary, Illinois Institute of Technology, Technology Center, Chicago 16, Ill.

Second Transport Aircraft Hydraulic Conference Announced

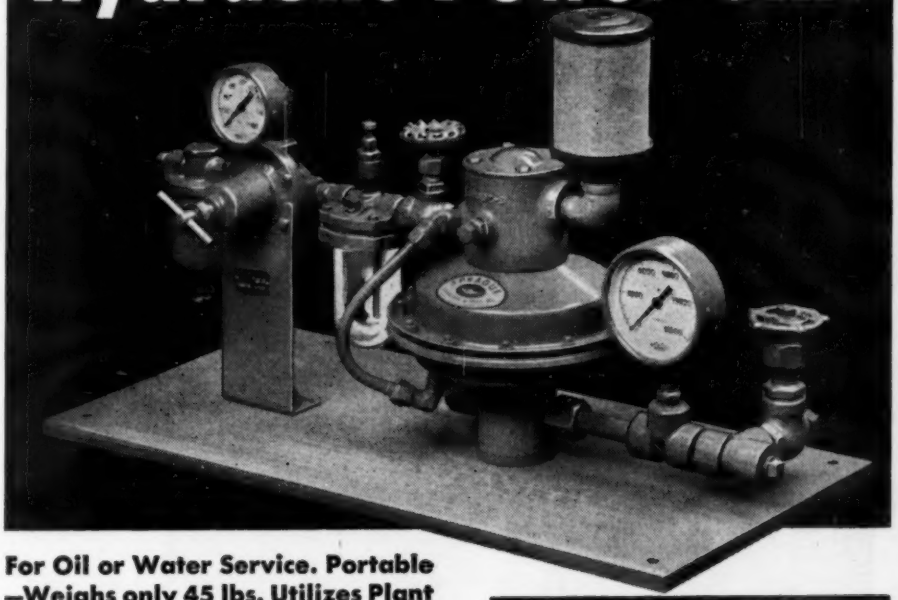
The second Transport Aircraft Hydraulic Conference will be held at the Park Sheraton Hotel, Detroit, on Tuesday and Wednesday, October 28 and 29, according to an announcement by Vickers, Incorporated, sponsors. William E. Spearman, assistant manager of service engineering for American Airlines, will act as general chairman of the meeting.

The agenda for the meeting which is being made up in part on the basis of suggestions from those who attended the first Conference, indicates that considerable attention will be given to new tubing materials and processes and the current status of safety fluid service where it is used instead of conventional hydraulic fluids. Several new Vickers designs and new hydraulic system designs will be considered.

The first Transport Aircraft Hydraulic Conference, held last December 4 and 5, was attended by 80 representatives from twenty airlines, five of them foreign, commercial airplane manufacturers, fitting and tubing makers, oil companies and Air Force and Navy BuAer personnel.

NEW AIR OPERATED

Hydraulic Power Unit

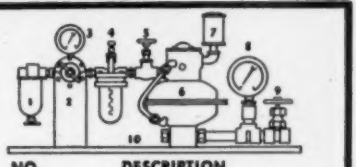


For Oil or Water Service. Portable —Weighs only 45 lbs. Utilizes Plant Air Supply to Provide Output Fluid Pressures to 30,000 PSI.

Sprague Model S-440 Power Unit is simple to install. Requires only two connections – one to plant air supply line and the other to manifold, etc. from outlet fluid port of power unit for *immediate operation.*

The Sprague pump operates *automatically* on the principle of differential areas. It can be furnished in six models with ratios of from 35:1 to 300:1 making possible an output range from 3,500 to 30,000 PSI. Measures 12"x12"x24" complete.

Models S-440 is broadly applicable for a wide variety of uses where low volume output at high pressure is the requirement, such as hydrostatic testing. Uses either oil or water as the testing medium. Write today for complete information.



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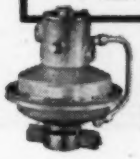
9	Bleed off Valve
8	Pressure Gauge
7	Air Muffler
6	Sprague S-216C Pump
5	Air Shut off Valve
4	Air Lubricator
3	Air Gauge
2	Air Regulator
1	Air Filter



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Sprague Model S-216C Air Operated Hydraulic Boost Pump is available as a separate unit for custom installations. Measures 8¼" wide x 9⅝" deep. Simple, reliable, inexpensive. Thousands in use.

SPRAGUE GAUGE PROTECTOR SHUT OFF VALVE

Automatically cuts out gauge from system when hydraulic or pneumatic pressure goes beyond its operating limit. Automatically opens when pressure is again within operating range of gauge. Available for low pressures—30, 60, 100, 200 and 300 PSI. and high pressures—500, 1000, 1500, 2000, 2500, 3000 and 5000 PSI. (Cut-in point approx. 80% of set cut-out point.) Write today for bulletin.

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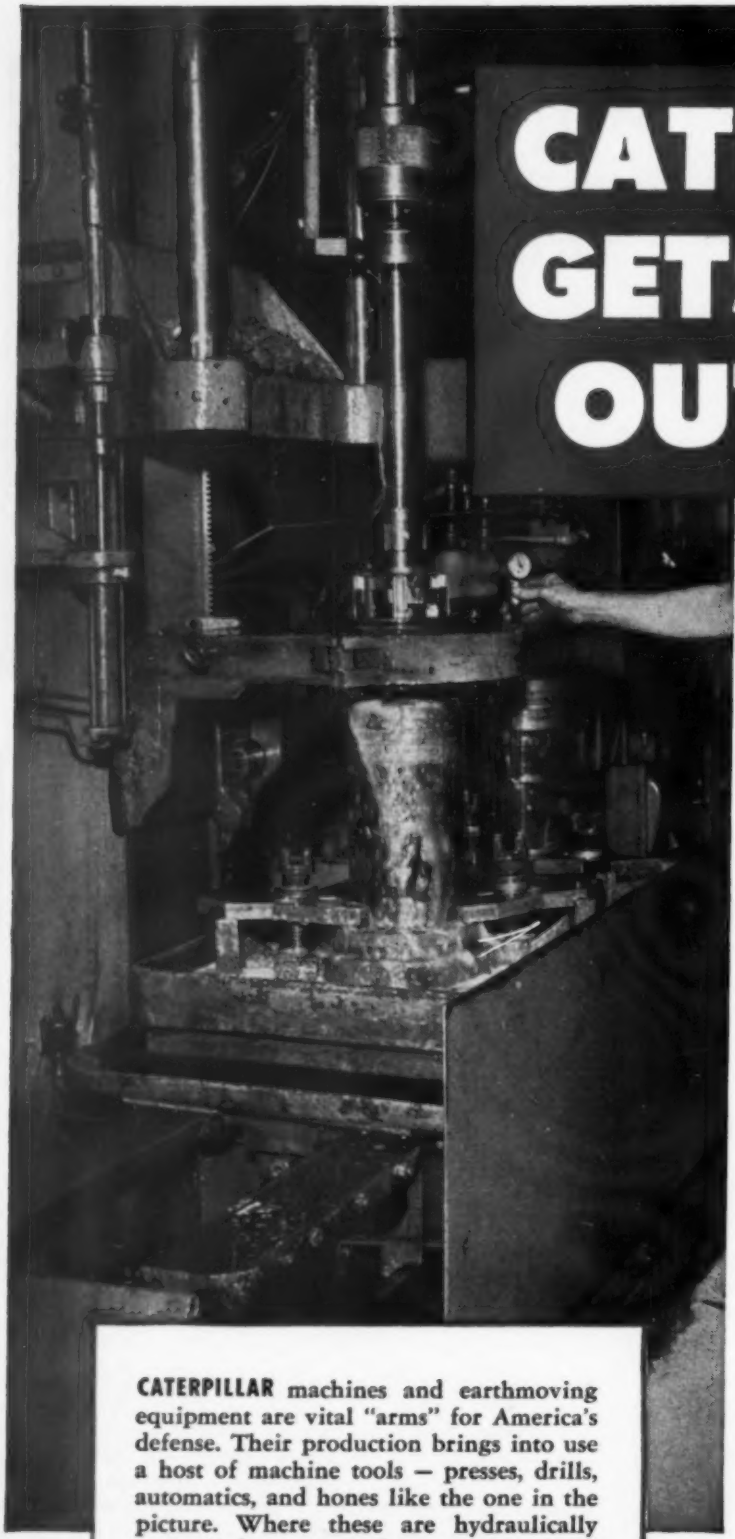


CATERPILLAR GETS ORDERS OUT FASTER

CATERPILLAR machines and earthmoving equipment are vital "arms" for America's defense. Their production brings into use a host of machine tools — presses, drills, automatics, and hones like the one in the picture. Where these are hydraulically controlled or operated, *Texaco Regal Oil (R&O)* as the hydraulic medium assures clean, trouble-free operation.

...with the help of TEXACO REGAL OIL (R&O) in hydraulic mechanisms

To maintain production and meet delivery dates, machines at Caterpillar Tractor Co.'s plants *must keep working.* Unscheduled stoppages of hydraulic mechanisms, for example, simply cannot be tolerated. So quality comes first in choosing a hydraulic medium. *Texaco Regal Oil (R&O)* has proved ideal.

For Caterpillar, as for other quality-wise manufacturers, *Texaco Regal Oil (R&O)* assures: 1) clean hydraulic systems; 2) smooth, uninterrupted operation; 3) protection of internal parts against rust; 4) longer operating periods between drains and overhauls; and 5) lower maintenance costs.

Texaco Regal Oil (R&O) is specially refined from choice base stocks, then processed and fortified with special Texaco additives. *Texaco Regal Oil (R&O)* is thus *more than ten times more resistant to oxidation* than ordinary turbine-quality oils, gives far greater protection against rust and sludge, and will not foam.

There is a complete line of *Texaco Regal Oils (R&O)* approved by leading hydraulic manufacturers. A Texaco Lubrication Engineer will gladly show you how they can improve performance and reduce costs in your plant. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO Regal Oils (R&O)

FOR ALL HYDRAULIC UNITS

Faithfully yours 50 *for Fifty Years*

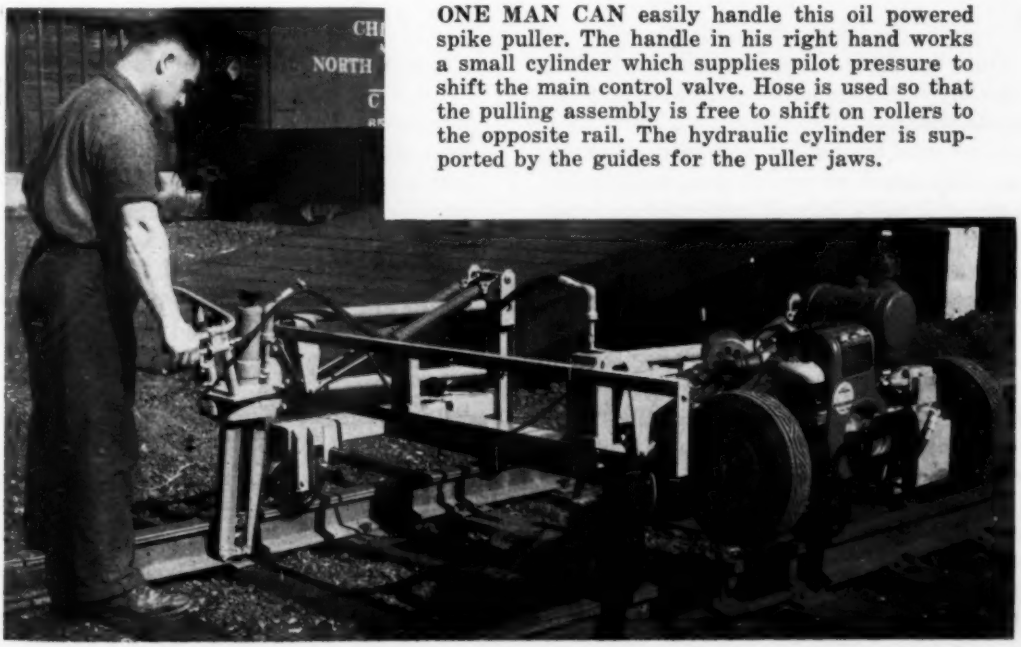
Hydraulic Power System in Portable Spike Puller Is Safer

"MAINTENANCE -of-way" equipment is the name given to machines which are used in the repair and care of roadway and structures in the railroad field. With the thousands of miles of track used throughout the country, care of road beds entails a major labor cost to the railroads. The introduction of machines to do much of the work has been slow by comparison with other industries. This has been due primarily to the problems of an always moving work station. It means that design of equipment for maintenance-of-way must consider portability as a basic feature. Along with portability, the machines must be rugged to withstand the outdoors and heavy work load. Equipment which is always on the move must be easy to service with a minimum amount of skill, tools or special parts.

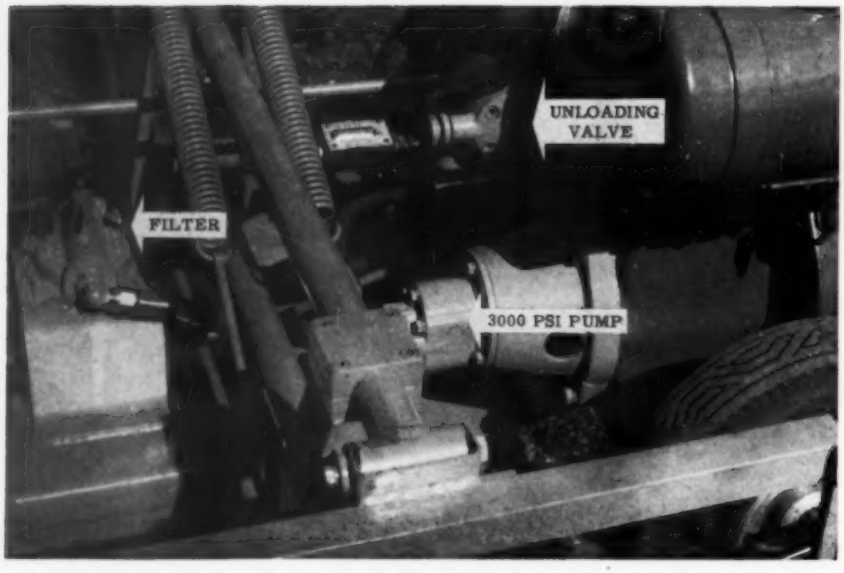
Fairmont Railway Motors, Inc. of Fairmont, Minnesota, has developed a hydraulic spike puller, having a pulling capacity of from 8 to 12 spikes per minute, which uses components that are compact and built for heavy duty. Development work involved extensive tests to reduce weight, and give a machine which one man can handle. Using hydraulic power to do the actual work gives a fast, smooth and steady pull for safe and efficient operation. Construction is such that the pulling assembly takes all the load. With all the load of the pulling stroke concentrated in the pulling head, there is no danger to the operator. The frame and complete unit can be made lighter since it takes none of the pulling load. The guides for the puller jaws act as legs and support for the 2½ inch bore, single acting cylinder.

Counterbalanced Assembly

The pulling assembly has a ball and socket mounting to permit some variation in order to properly locate the jaws over the spike. The puller mounting has sealed ball bearing grooved wheels operating on a transverse track to allow the unit to pull spikes from



ONE MAN CAN easily handle this oil powered spike puller. The handle in his right hand works a small cylinder which supplies pilot pressure to shift the main control valve. Hose is used so that the pulling assembly is free to shift on rollers to the opposite rail. The hydraulic cylinder is supported by the guides for the puller jaws.



SMALL PRESSURE loaded gear pump, capable of developing 3000 psi, is directly driven at 3250 rpm by a single cylinder, 4 cycle air cooled engine. Pump unloads its volume to tank after charging the accumulator to 3000 psi.

POWER SYSTEM on the spike puller uses a 75 cu in, bladder type accumulator, with a gas charge of 1200 psi, to speed the operation. An 8 gpm large area filter on this system, which uses a 2.5 gpm pump, assures trouble-free operation. Valves are subplate mounted to the top of the cast aluminum reservoir to simplify hose connections, minimize possibility of leakage at exposed fittings, and give a strong assembly. All components are readily accessible for service and the reservoir filler opening is unobstructed.

either rail while traveling in one direction. Pulling assembly is merely shifted from one end of the supporting track to the other.

For easier operation the pulling assembly, mounting and track are supported by spring counter-balanced pantograph arms. It takes little effort to raise or lower the assembly, or to shift from one rail to the other.

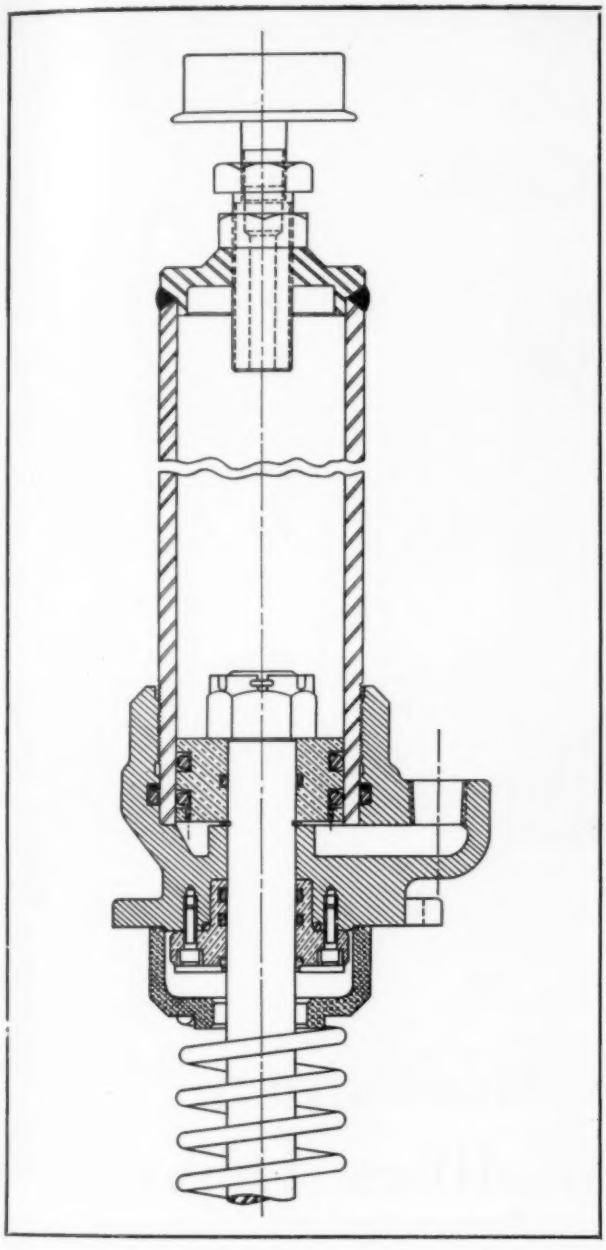
To hold down the weight and physical size of hydraulic components, the system was designed to operate at as high a pressure as is practical using commercially available components. Working pressures of hose and the availability of a compact gear pump were the determining factors in selecting a 3000 psi maximum. This permitted using a 2½ inch bore cylinder with a 1 inch rod diameter, giving a starting force of approximately 6 tons!

Another weight saving feature is the use of a cast aluminum reservoir and a bar stock aluminum cover on which the subplate type directional control and unloading valve and the accumulator are mounted. Total weight of the machine is 685 pounds.

Use of a 75 cubic inch, bladder type accumulator provides for fast pulling action. The accumulator is precharged with nitrogen at 1200 psi. The 2.5 gpm gear pump, direct driven at 3250 rpm from a single cylinder gasoline engine, pumps oil into the accumulator to a pressure of 3000 psi as determined by the unloading valve setting. With the accumulator charged, the pump dumps its volume to the reservoir at zero pressure to relieve the load on the driving engine.

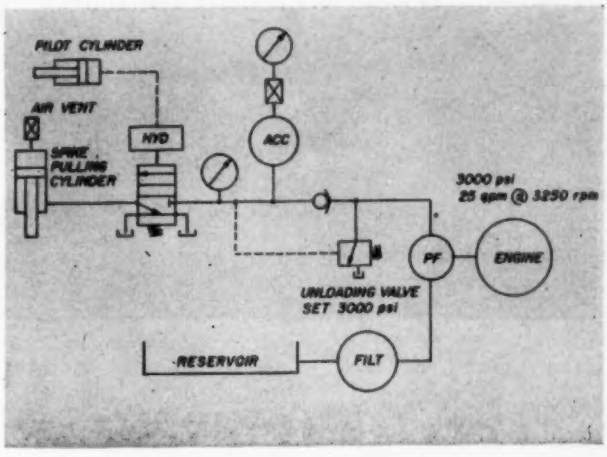
Accumulator Speeds Operation

At the start of the pull, 3000 psi pressure from the accumulator acts on the cylinder rod end. As the spike is pulled out, and oil volume flows from the accumulator to the cylinder, pressure drops in direct proportion to the increase in the volume of the gas charge in the accumulator. Where the full pulling



SPIKE PULLING cylinder design shown in this cross-sectional drawing illustrates the use of "O" ring seals in both the rod and piston glands. Note the 1/32 inch diameter holes in the piston head through which oil pressure is exerted on the ring to create the piston head seal. A threaded stud attached to the breather may be adjusted to limit the piston stroke for various spike lengths.

SCHEMATIC of the hydraulic circuit clearly shows the simplicity of the power system. The pilot cylinder has a small self contained oil reservoir to assure an adequate supply of oil in this line at all times. The 4-way valve has a special spool which permits return oil from the single acting spike pulling cylinder to rapidly return to the reservoir through two ports.



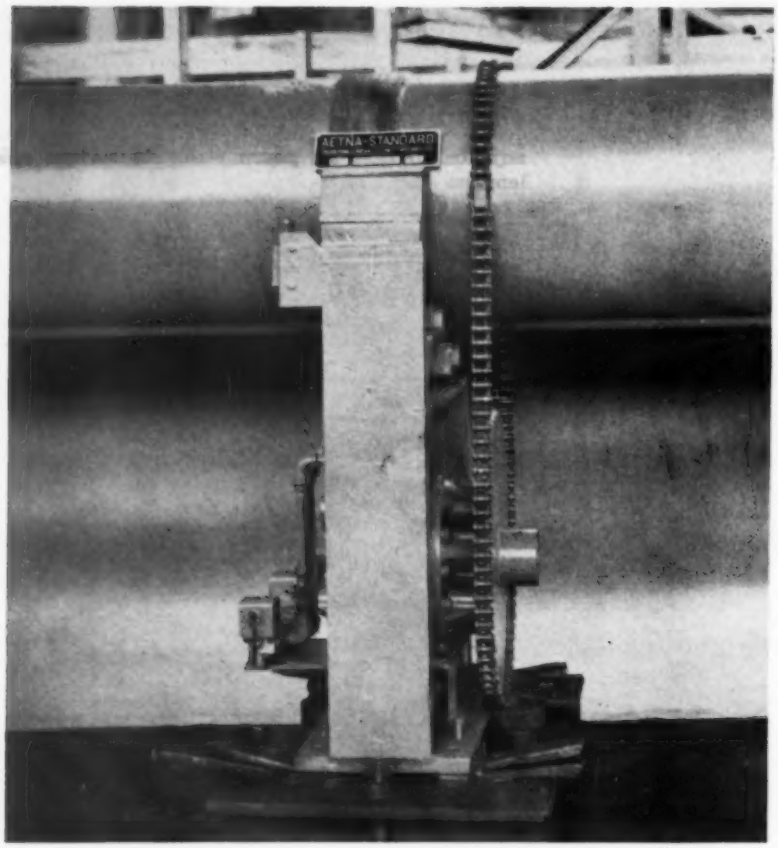
stroke of 7 inches is used pressure at the end of the stroke is approximately 1400 psi, which exerts a force of 2½ tons.

To assure trouble-free operation in the field, the final system has a minimum number of components. Valves are subplate mounted to provide a rigid assembly and reduce the number of exposed fittings. A filter in the pump suction line keeps dirt from impairing the pump and valve operation, and at the same time its large capacity prevents pump starvation which could be caused by excessive pressure drop in the suction line.

One of the first designs used a mechanical linkage to shift the directional valve. This linkage was not positive because the enclosed cable would occasionally foul itself and become inoperative. The valve actuating cable had to move with the pulling assembly when it was shifted between rails. To solve this control problem, pilot actuation of the valve was installed. The pilot pressure system is a closed system which operates independently of the pump and accumulator. A pilot hose line leads from the control valve's pilot port to a small cylinder located at the operator's handle. This cylinder acts as a small hand pump and has its own oil reservoir to keep oil in the pilot line at all times. Squeezing the handle, pumps oil to shift the control valve spool. When the handle is released, the spring in the control valve shifts the spool and forces oil out of the pilot chamber back to the pilot cylinder on the operator's handle.

Changing the stroke length for different spikes is easily accomplished by adjusting the threaded stud which holds the breather at the top of the cylinder and acts as a piston stop as well. Railroad spikes vary in length between the various railroad companies, and in order to save as much of the accumulator pressure as possible and also to speed up the operation, the stroke is limited to that only necessary to withdraw the spike from the tie.

Mechanical spike pullers require as many as three men to operate and can be dangerous if an operator should be careless. Hydraulic power, which can easily be concentrated at the work and can be controlled to provide more than enough pulling force, results in a machine which is safe, flexible and has low maintenance.



CLOSEUP of the rollover drive. Air, controlled by the double solenoid valve seen mounted at the left, powers the rotary cylinder. The cylinder shaft rotates 270 degrees to turn the tube holder 180 degrees.

Pneumatic Rollover Mechanism Saves Space and Simplifies Drive

By Paul Beacom

DESIGN of a rollover drive for a tube drawbench mandrel end requires a power system which will rotate the mandrel 180 degrees. Rotation of the mandrel places three tubes in position for draw and permits three more tubes to be loaded during the draw operation. The cross-sectional drawing of the barrel clearly shows the job which a reciprocating rotary drive must perform.

Built by The Aetna-Standard Engineering Company, the compact drive uses a rotary cylinder or torque actuator which is powered by air to rotate the barrel through a sprocket and chain drive. The rotary cylinder provides smooth reciprocating rotary power. Using lubricated air, this reciprocating fluid motor gives a torque output of 12000 inch pounds at 100 psi through any arc of 280 degrees or less. For this drawbench application, the reciprocating action is stopped at approximately 270 degrees with the chain drive giving 180 degree movement to the barrel.

Construction of the torque actuator provides a very compact unit measuring approximately 14 inches in diameter and 24 inches in overall length. It consists of a cylindrical body enclosed at both ends by sealed heads; the shaft is attached to a vane which rotates in either direction as the pressure is applied. A shoe or stationary abutment, running parallel to the shaft, divides the cylinder into two compartments; the vane rotates from one side of the shoe to the

PAUL L. BEACOM, Chief Draftsman, Cold Draw Division, The Aetna-Standard Engineering Co.

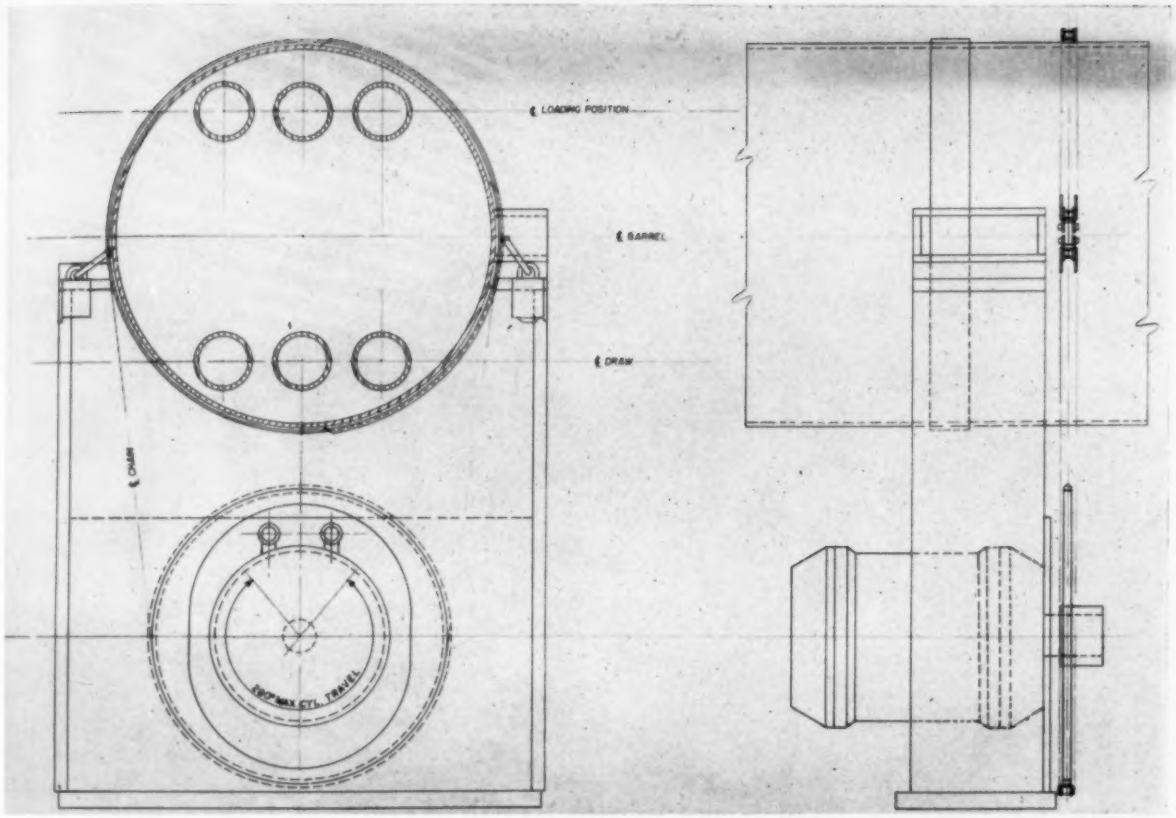
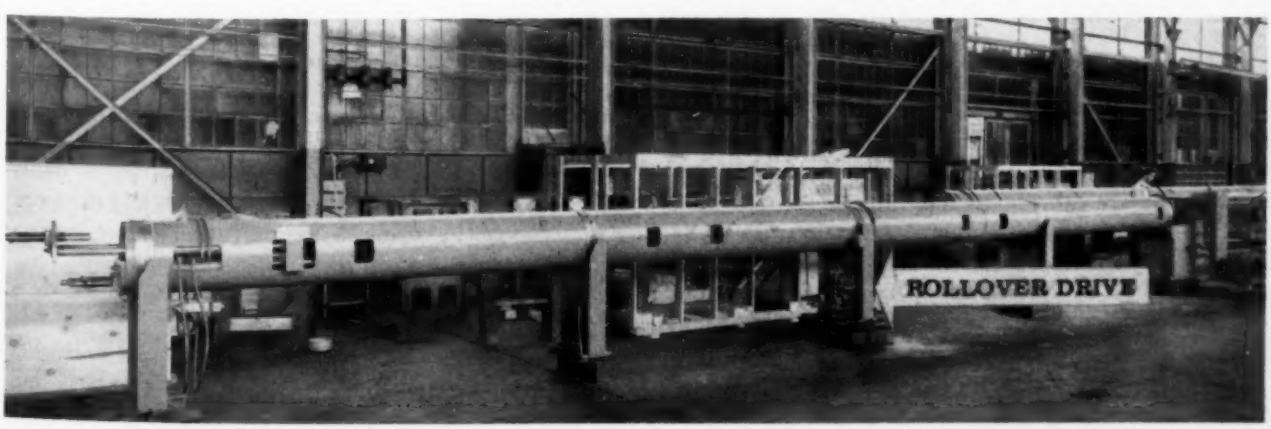


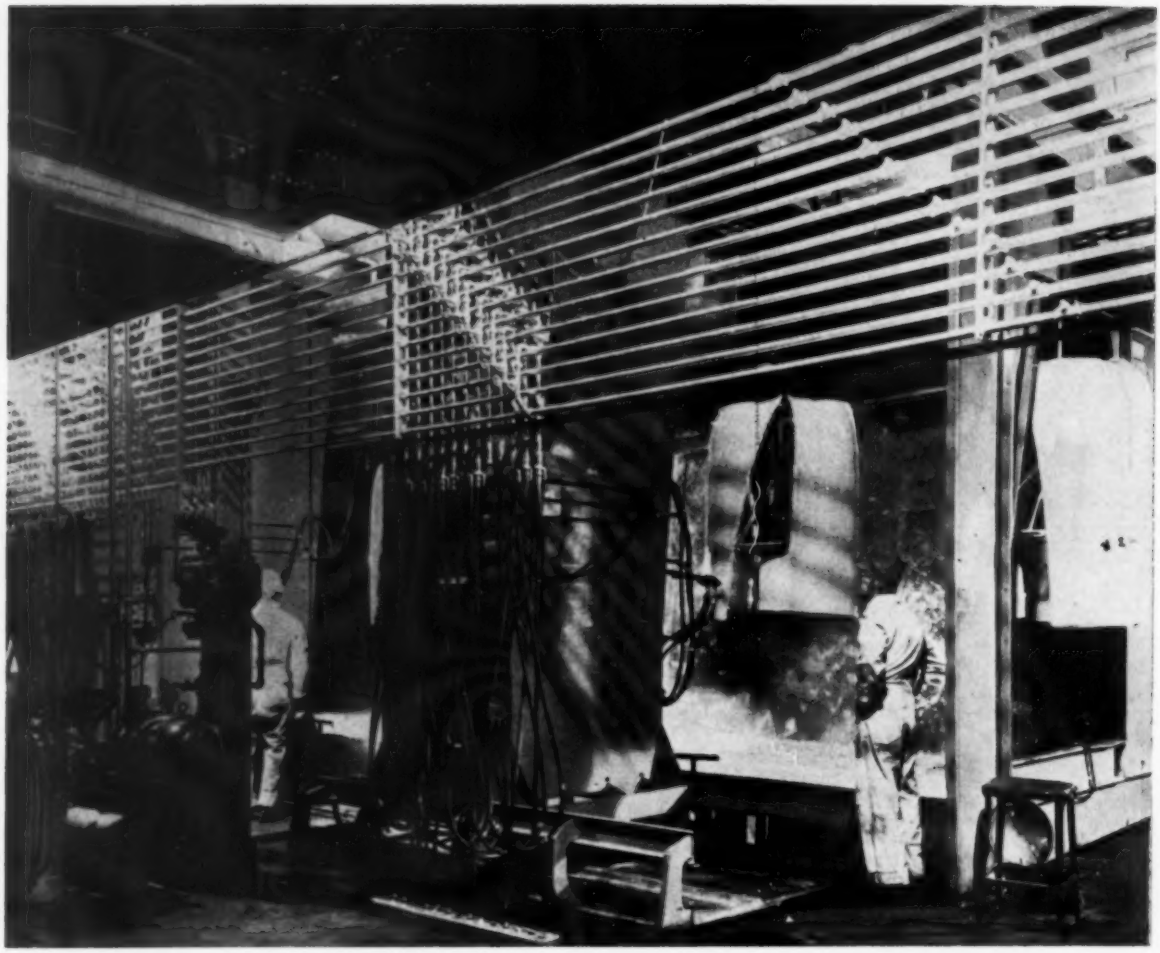
DIAGRAM OF THE DRAWBENCH mandrel rollover drive shows the loading and draw position for the barrel. Barrel rotation is limited by positive stops. The limit switches are in the electrical circuit which control the drawbench operation.

other. On the draw bench application, the shaft rotation is stopped by an external positive stop so that the abutment acts only as a seal between pressure and discharge ports and does not serve as a stop for shaft motion.

Of course, several other approaches to the design of a mechanism to rotate the barrel were considered. Any mechanical system would be cumbersome and require too much effort and time from the operator. An electric motor, with the necessary start-stop controls, would be costly. A linear air cylinder has been used in previous designs before the development of the torque actuator. This mechanism requires a more complicated linkage involving a rack and gear arrangement to convert the linear motion to rotary motion. The resultant system is neither as compact or as free from care and adjustment as is the torque actuator mechanism.

MOUNTED ON THE CENTER support of the tube holder, the rollover drive is a compact air driven unit. Tubes are pulled from this mandrel barrel through a drawbench. The rollover drive positions the tube holder for loading. These barrels are built in lengths up to 100 feet.





HYDRAULIC POWER MOVES the spray booth at the same speed as the motor driven conveyor carrying the sheet metal parts which are seen being painted. Speeds must be closely synchronized.

Directional Valve Design Solves Speed Control Problem

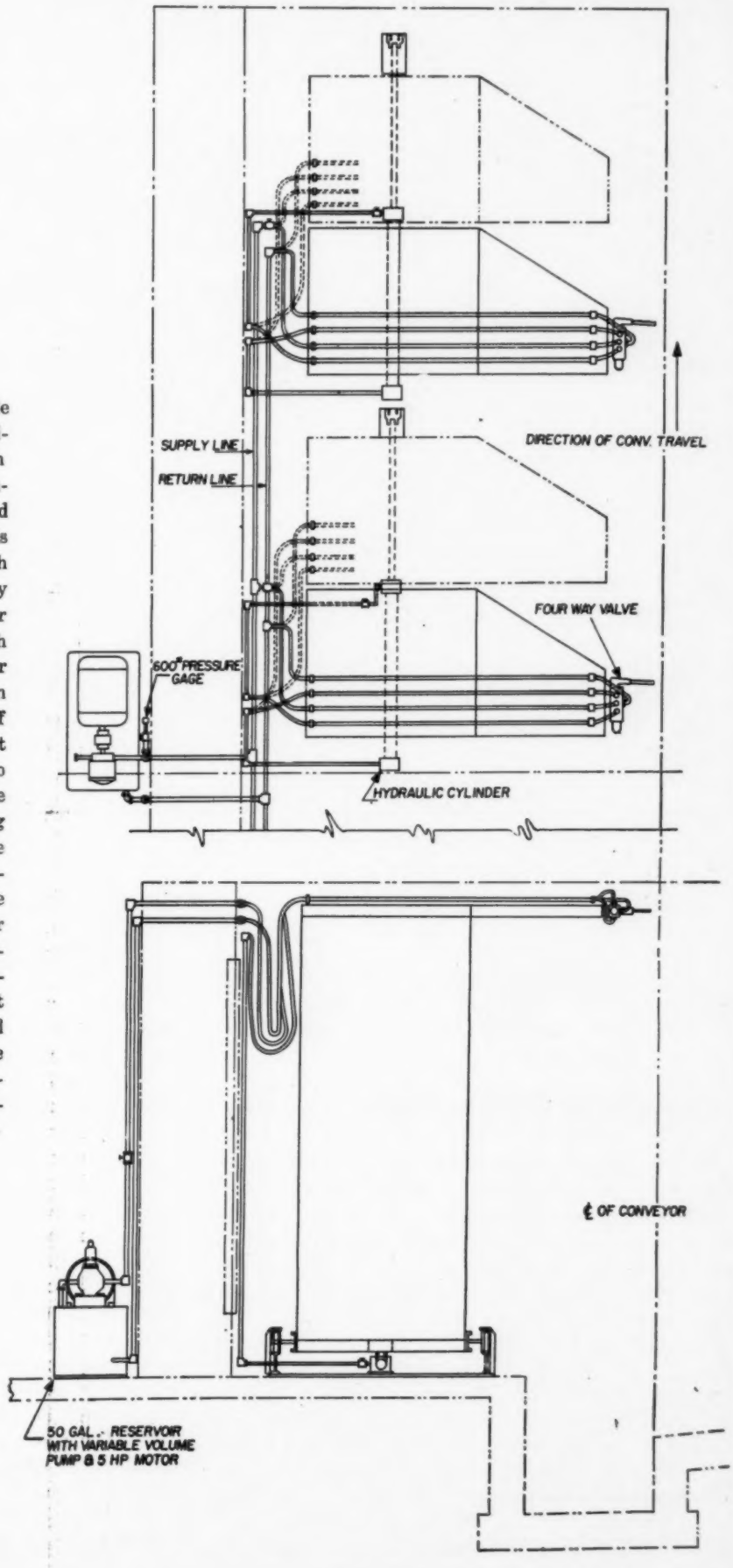
By John Tietgen

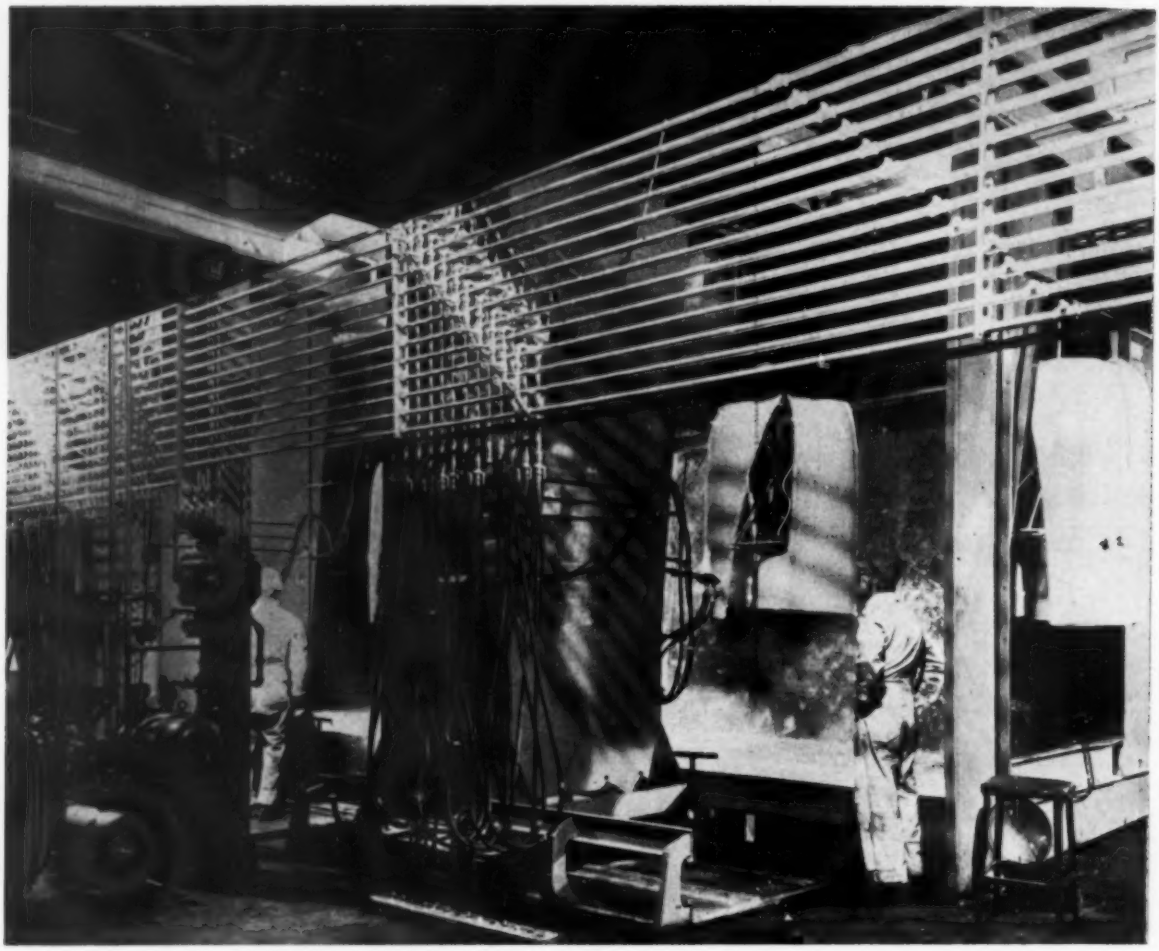
SYNCHRONIZING the speed between a motor driven conveyor which carries the work and a hydraulically powered paint spray machine is accomplished with an elementary hydraulic circuit and a carefully planned mechanical linkage to actuate the directional valve. The oil circuit has only the necessary components—a variable volume pump to supply the pressure oil, a cylinder and a two position, 4-way valve to direct pressure to either end of the cylinder. A needle valve is used in the rod end line to provide rough adjustment. However, fine accurate control which holds the same speed between the spray cabinet and the work is achieved by using a special valve sleeve having tapered ports, and by designing a spool positioning linkage which automatically compensates for changes in conveyor speed.

As a result of this design the directional valve becomes what we call a "proportionating valve", because the flow of oil through the valve is proportional

JOHN TIETGEN, Chief Engineer, Schweitzer Equipment Co., Cleveland, Ohio.

HERE IS A PLAN VIEW and side elevation of two paint spray cabinets which are moved in step with conveyor speed by hydraulic cylinder action. Each cabinet mounted on rollers running in channels, is shuttled by a 3 in bore, 42 inch stroke cylinder located centrally beneath the cabinet. The power pack at the side of the spray booth supplies oil to a pressure header which supplies all the cabinets in the spray booth. Oil is tapped off the header to the control valve at the top of each cabinet and then to the double acting cylinder. The drawing clearly shows the piping layout. Hose is used between the valve and cylinder to permit machine travel. There is a needle valve in the rod end line of each cylinder to provide additional speed adjustment. Any number of these cabinets can be arranged in a paint line and lengths of travel and speeds can be altered to suit the production requirements. The simple hydraulic powering arrangement is readily applied to any variations in spray booth layout.





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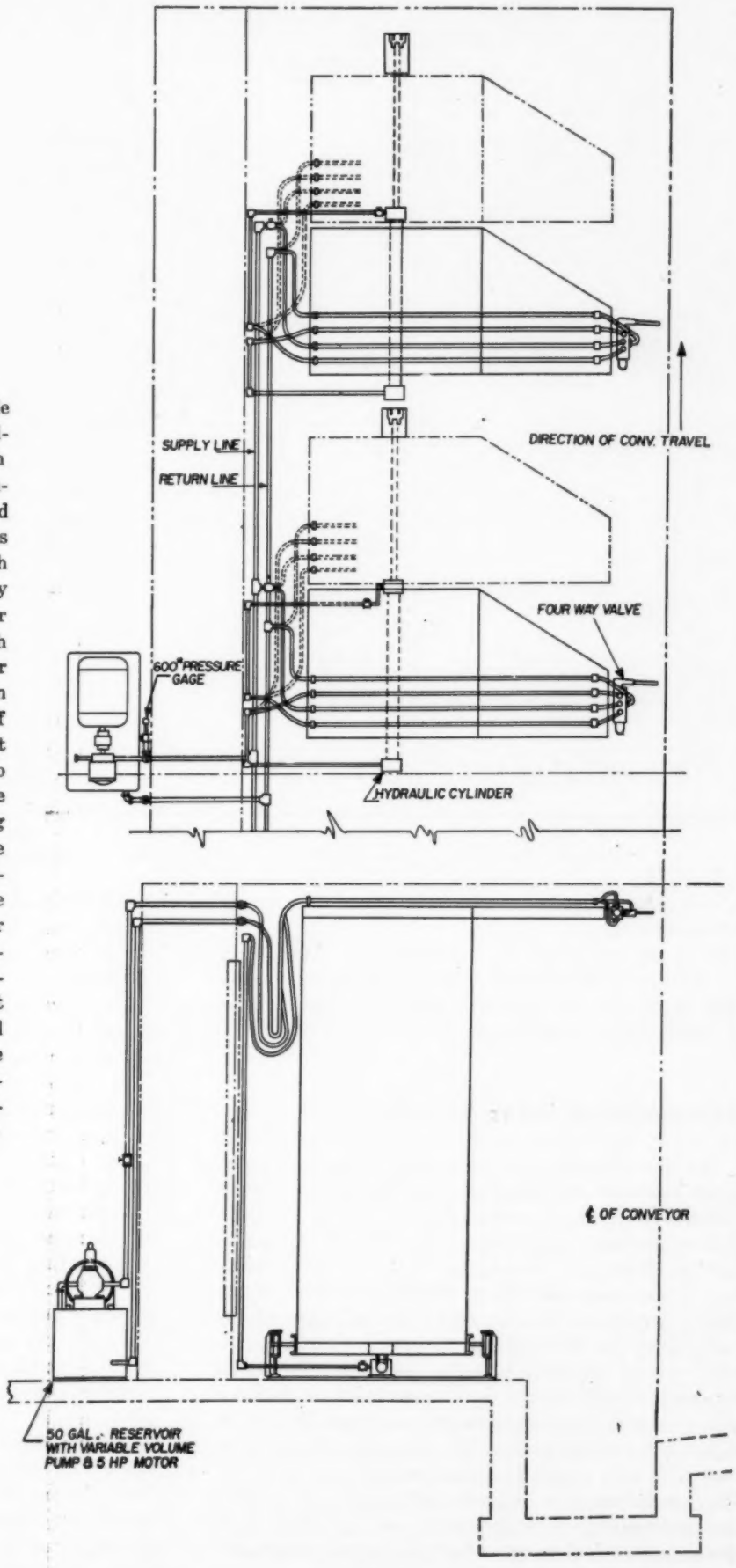
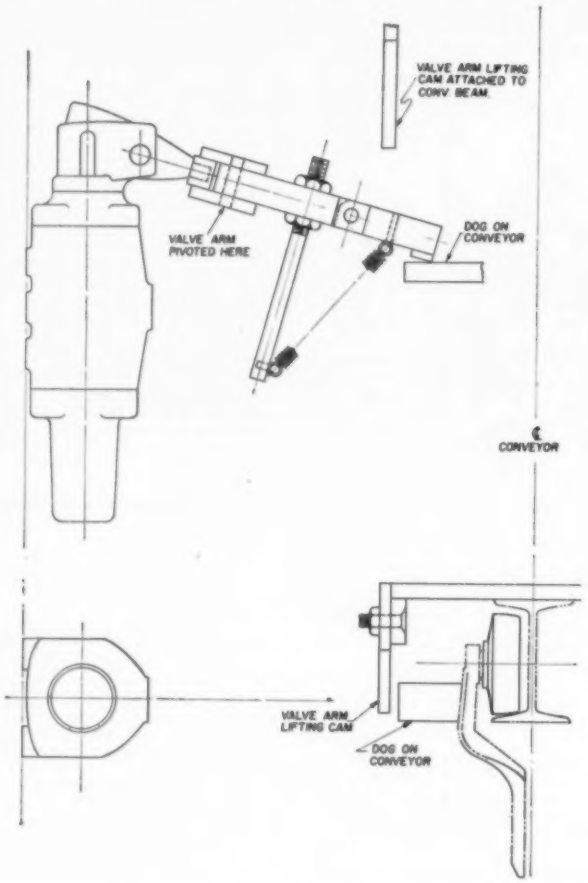



VALVE ARM LIFTING CAM ATTACHED TO CONV BEAM
VALVE ARM PIVOTED HERE
DOG ON CONVEYOR
℄ CONVEYOR
VALVE ARM LIFTING CAM
DOG ON CONVEYOR

DESIGN OF THIS VALVE linkage and the use of tapered ports results in a cabinet speed which is proportional to the conveyor speed. A 4-way, spring offset valve mounted at the top of the spray cabinet has its spool positioned by a dog on the conveyor which carries the work. The dog acts against the linkage shown here. Ports in the valve sleeve are tapered to provide flow control as the spool position changes with conveyor speed. The tension spring on the linkage is a safety feature which permits the dog to pass the valve actuating arm if the moving cabinet should jam for any reason. At the end of the cabinet travel, the valve arm rides up the lifting cam to permit the conveyor dog to pass under it. The arm is pivoted so that it will lift. The valve spool shifts to its normal position to direct oil to return the spray cabinet.

to conveyor speed. In a sense this system is a simple servomechanism.

Designed and built by the Schweitzer Equipment Co., Cleveland, these paint spray machines are finding wide application in industries having a high volume of painted sheet metal parts.

Advantages of Drive System

The development and application of movabie paint spray machines has resulted in substantial savings to automotive plants in which they are being used. In high production paint operations, sheet metal parts, such as fenders or hoods, are hung from an overhead chain conveyor which carries them through the paint machine and into the drying ovens. Several parts hang from one holder and the parts must be spun when being painted. Also the paint spray gun is automatically positioned by a cam track to be kept at a constant distance from the work profile and at right angles to the profile. The spray gun speed must vary with part profile to assure an even coat of paint. The synchronization between gun travel, work rotation and varying work contour is accomplished by an electro-mechanical system which is not tied in with the hydraulic system which moves the cabinet.

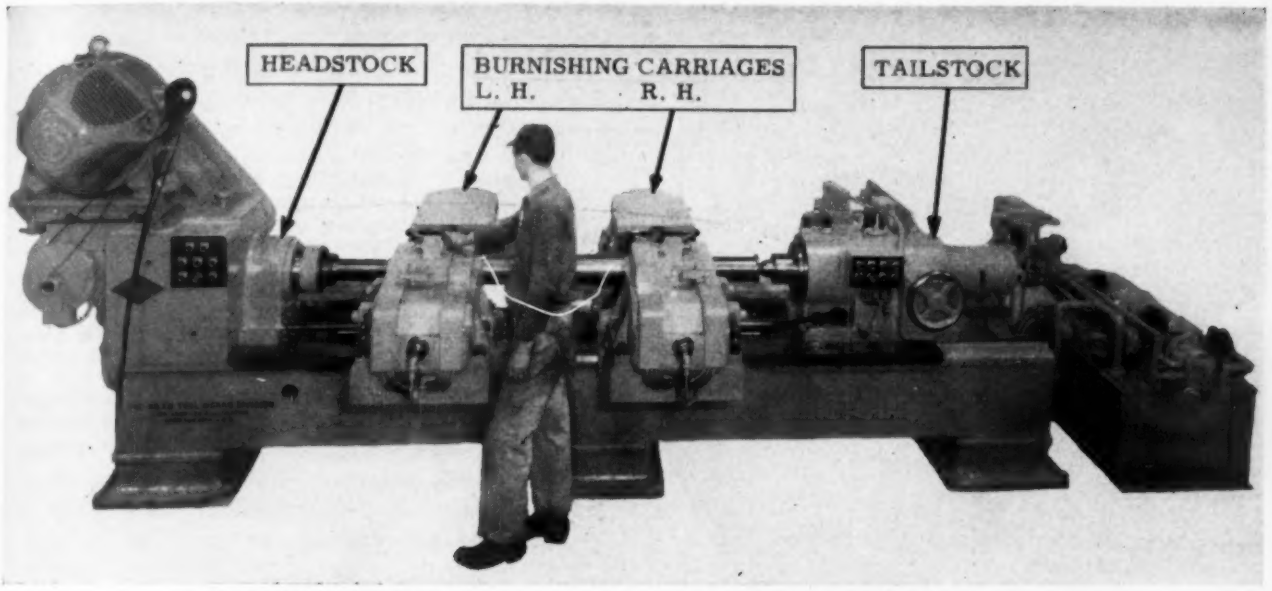
The work holding rack is spun at a definite number of rpm, when it comes into the spray area, by means of a friction drive to a wheel fixed to the rack support just below the conveyor.

There are usually four or more spray cabinets in the paint booth and, when painting hoods and fenders, they are arranged so that the first and third cabinets spray hoods, and the second and fourth spray fenders. The spinners change direction of rotation between the first and second coat.

When automatic paint spraying first came into use, the cabinets were stationary and it was necessary to stop the work in front of the spray guns, the work would rotate while the gun moved to follow the contour. This intermittent conveyor travel had a number of shortcomings which have been eliminated by having a continuously moving conveyor with a moving spray cabinet. The most important gain has been reduced maintenance, because downtime due to the complex conveyor stop-start system has been eliminated.

Because stop-start action caused the work racks to swing and often shook down dust on the work surfaces, introduction of continuous movement has improved the quality of work. Using a moving cabinet permits spacing the work holders on closer centers

Concluded on page 97



JOURNAL SURFACES on a railroad car axle which is mounted between centers, are being burnished. Oil pressure powers the centers and provides longitudinal and cross feed for the burnishing rolls.

Controlled Pressure System

. . . eliminates surface finishing variations

By Z. C. Van Schwartz

THE Niles Tool Works of the Baldwin-Lima-Hamilton Corporation recently completed and put in successful operation a new burnishing lathe which will finish the machine tooled journals of railroad axles. This lathe is equipped with a controlled hydraulic pressure system to the burnishing rolls, feed/traverse mechanism and also to the headstock and tailstock centers.

Old, conventional methods using mechanical means in burnishing the journals of axles involved many risks relative to quality, since the burnishing operation was usually accomplished by forcing a burnishing roll (or rolls) against the axle by the operator with the use of mechanical means. With the human element involved, no two finished axles were found to be exactly alike at the end of a working day. A variation between finished axles, particularly the quality of the finish, was persistently noticeable.

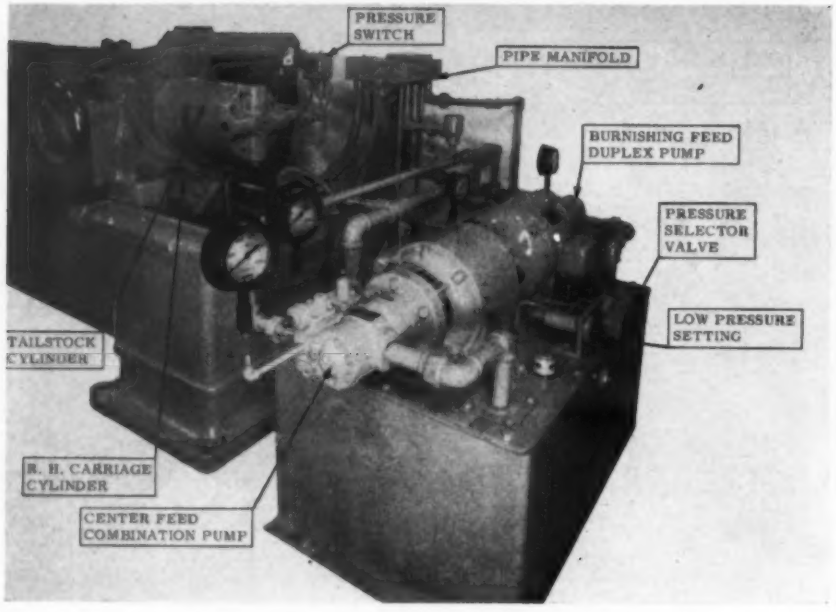
The object of this new burnishing lathe was to eliminate all of the variables due to the human element and to alleviate the foregoing deficiencies of the old method by producing consistently uniform quality axles at an accelerated production rate.

The problems of locating the workpiece, supporting it and holding it safely while in the machine pointed clearly to the application of fluid power.

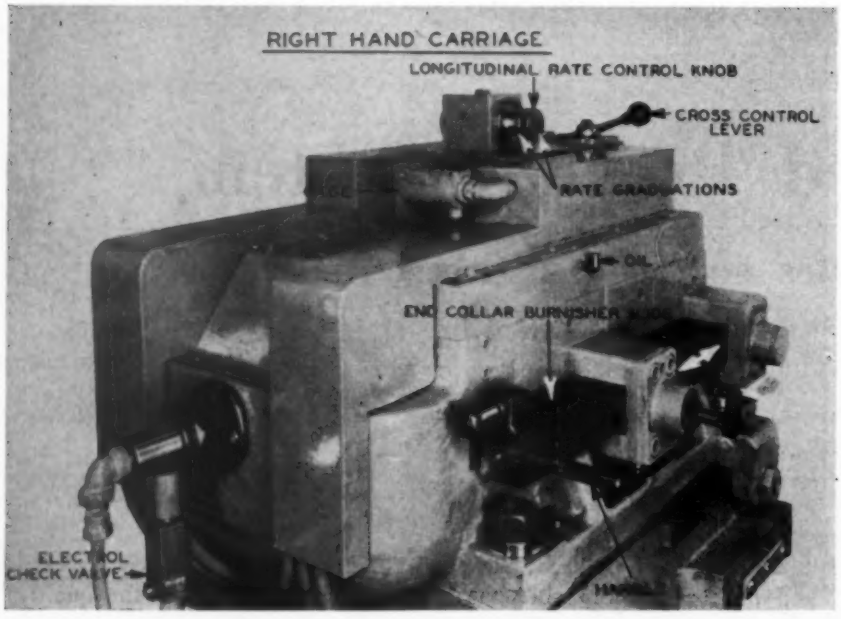
With the use of hydraulics the operator has been relieved of the arduous burdens of the old method. This factor alone greatly contributed to higher productivity and uniform quality.

The elimination of human element not only enhanced productivity but added to the safety and welfare of the operator. The operator is fully protected by adequate safety measures during all phases of

Z. C. VAN SCHWARTZ, Administrative Mechanical Engineer, Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio.



OIL FOR MOVING the tail and head centers is supplied by the combination pump seen in the foreground. A duplex pump, mounted on the other end of the oil reservoir, powers the burnishing rolls and carriages. On the right side of the tank is the pressure selector double solenoid valve and low pressure relief valve for the right hand carriage. A similar arrangement for the left carriage is hidden from view by the two 3 HP motors which drive the pumps.



FEED AND DIRECTIONAL control of the carriages and feed cylinders is provided by a special control valve mounted on the top of the carriage. The cross feed control lever permits the operator to move the rolls rapidly in, and a feed and rapid speed out. A similar feed control knob, provides rapid traverse and feed speed in either direction for the carriage. A pressure gauge gives a visual control over working pressure.

operation and if the machine should stop because of power failure.

Burnishing railroad axles present several unique manufacturing considerations, because this is a critical process. Pressure on burnishing tools must be accurately and positively controlled with a minimum of effort on the part of the operator. This is also true of feed rates. Because of the long bearing surfaces on the various sizes of axles, a feed/traverse mechanism to move the burnishing rolls had to be incorporated in the machine.

The shape of the axle and the various burnishing operations on it require that the workpiece is held on centers and revolved without the use of obstructive chucking means. The obvious answer was the aligning driving plate upon which the driving force is exerted by the differential pressure rates between the headstock and the tailstock cylinders.

The machine consists of a bed which supports a fixed headstock, a tailstock which is longitudinally adjustable on the bed-ways to suit various axle lengths and carriages which have cross slides in the front and in the rear fitted with opposed burnishing rolls. These burnishing rolls are mounted in sets, but in opposed position on each of the carriages. All these components are hydraulically operated.

Every component member of this machine, having a functional movement such as the headstock and the tailstock spindles, the carriages and their cross slides are hydraulically actuated. Operating effort is reduced to finger-tip control by conveniently located hydraulic and electric push button control stations. Burnishing pressures are obtained automatically, an advantage especially evident when rolling fillets.

The end of the headstock spindle is provided with a self-aligning driving plate which drives the axle by means of frictional contact through hydraulic pressure from the tailstock spindle. The headstock is provided with a double acting hydraulic cylinder for retracting the spindle center when loading or unloading axles. When the axle is in contact with the driving plate in the loaded position, the spindle center is held in the axle center hole by hydraulic pressure.

The problem of rates of feed and pressure control is solved by the use of a carefully designed hydraulic system.

Circuit Operation

One hydraulic control valve is mounted on the top member of the front cross slide on each carriage. Each control valve has two operating levers, one for the feed and traverse motion in either direction of its respective carriage, the other lever on the control valve is for moving the burnishing rolls against or away from the axle. Both levers are directional in operation. The infinite selection of feeds to the carriages is by a rate valve combined with the control valve. All feeds are in inches per minute.

In the circuit drawing, the flow pattern in the control valve for the left hand carriage is shown. The carriage control handle has five positions: stop, with all ports blocked; rapid right; feed right; rapid left; and feed left. The symbol indicates flow through the valve in each position. In the feed positions, oil flows through the built-in pressure compensated flow control valve which provides for the infinite selection of feeds.

The hydraulic pump unit consists of a duplex pump and a combination pump, these are mounted on the oil supply tank. The duplex pump provides independent pressure operation for feed and traverse to the burnishing rolls on the right hand and left hand carriages. The combination pump provides for sequence operation of the headstock center and the tailstock center. All movements of the headstock and tailstock centers are in sequence and properly interlocked. All solenoid

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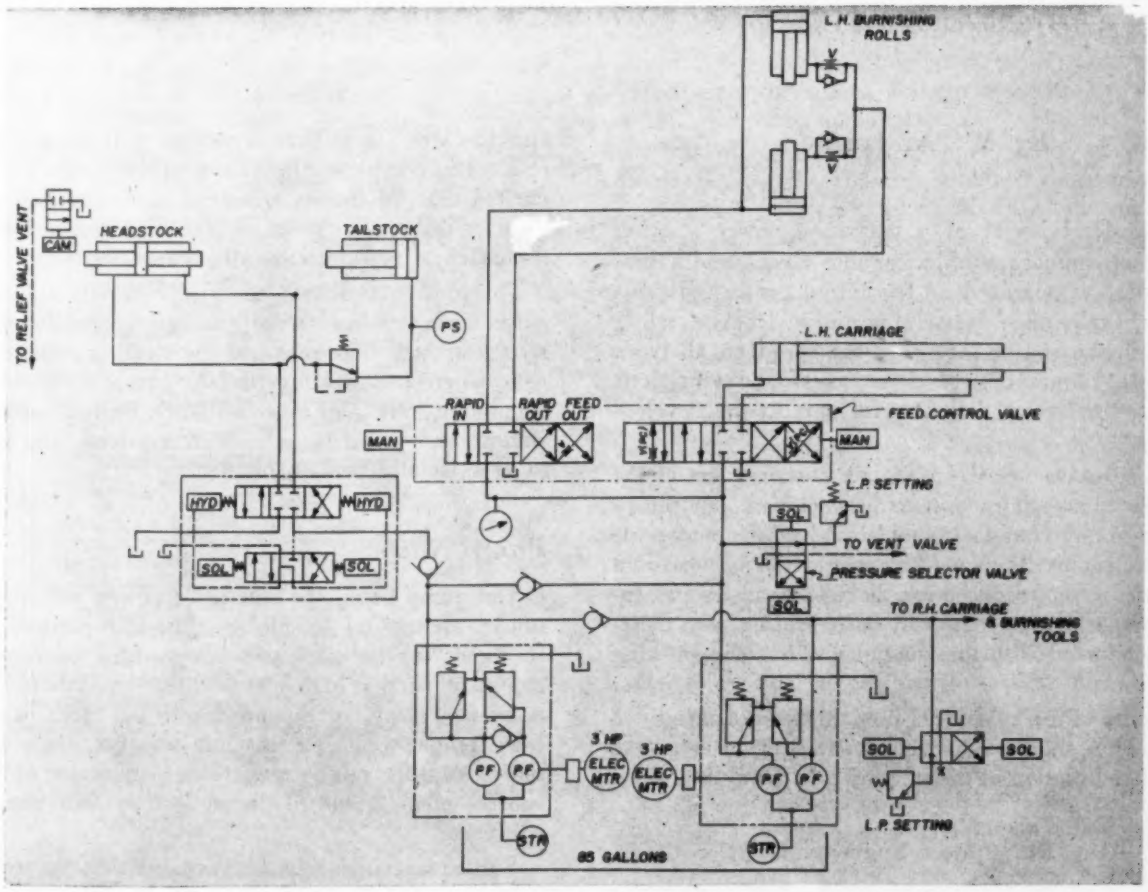
HYDRAULIC CIRCUIT for the work holding centers and the left hand carriage and burnishing tools. Flow through the special control valve, which has three positions for tool travel and five for carriage travel, can be traced. A clamping force of 2940 pounds can be obtained with a pump pressure of 600 psi; and a carriage force of 6280 pounds with its pump pressure at 500 psi.



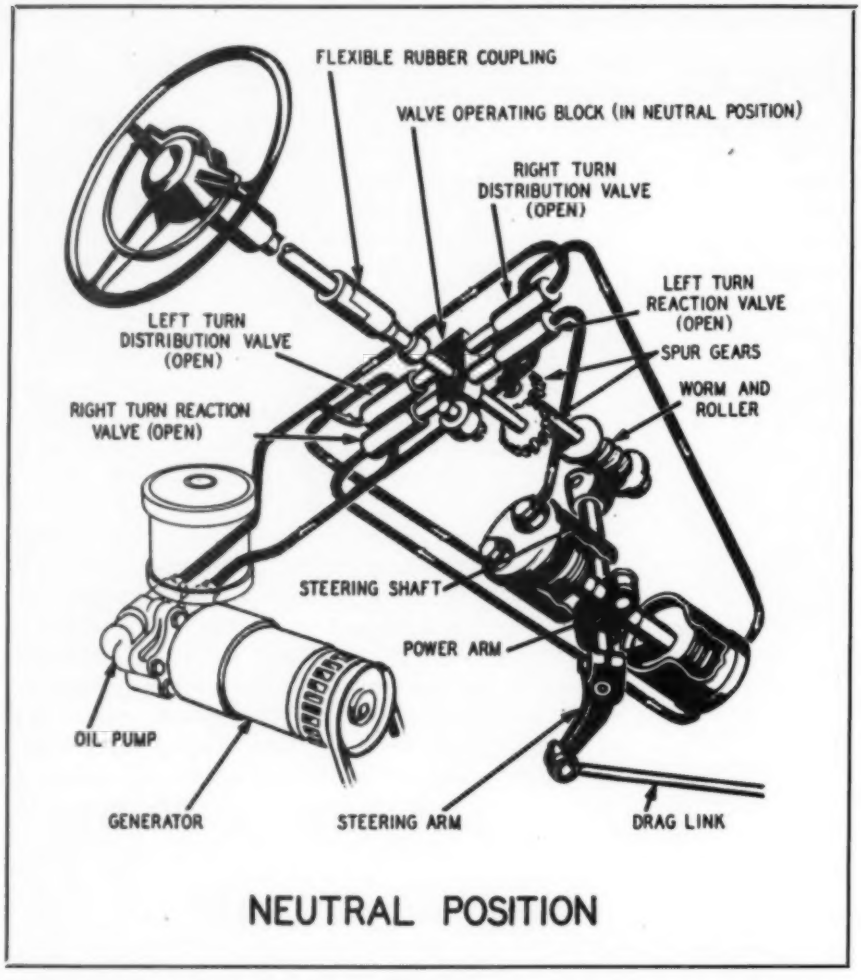


FIG. 1. SCHEMATIC of the Chrysler power steering system. Investigation showed that system noises were carried through the steering column and the nearby frame.

in Hydrauli

By W. A. Hunter

In the development of a hydraulic power steering system, numerous objectionable noises and vibrations were experienced on the initial car installations under nearly all driving conditions, from standing still with the engine idling, to top speed on all types of roads. Elimination of these noises and vibrations presented the most difficult problems in the development.

The noise level in the passenger compartment of the car was many times that experienced on laboratory testing of the chassis assembly and component parts in quiet rooms. Pumps which could not be heard in the quiet room produced excessive noise in the passenger compartment of the car. Most testing was therefore conducted with the components in their working environment.

Sources of the noises and how they were transmitted into the passenger compartment were first investigated. Complete isolation of the steering gear from the frame, and the steering column and jacket from the body resulted in complete elimination of the noise. This indicated that the noises were not air-borne, but were conducted through the steering column and jacket and the nearby frame to body attachment.

This apparent solution was really of only diagnostic value, since satisfactory noise isolators permitted excessive destructive movement of the steering column and gear, whereas satisfactory isolators from the structural standpoint were poor noise isolators. Partially effective column and jacket isolators were retained. The frame to gear isolator was abandoned.

Pump Noise

The pump being the source of power was also the source of most of the noises. Pump noise was most severe during the high pressure parking operation at engine idle and at high speeds, due to cavitation. Pump noise frequency corresponded with the tooth or rotor lobe frequency. There was not one, but many pump noises of this same frequency. Separation of these sources of noises all of the same frequency was very confusing.

Subsequent investigation revealed that the sources

W. A. HUNTER, Project Engineer, Chrysler Corporation.

Reducing Noise and Vibration

uli Power Steering Systems

Careful design of pump rotors, eliminating air in the system and preventing cavitation at the pump suction port greatly reduce noise problems. Pulse filters are effective and where possible noise isolators are used.

of the pump noises were:

1. Gear or rotor noise caused by (a) imperfect tooth action, (b) imperfect mating of rotor contours, (c) improper center distances, (d) misalignment in assembly, and (e) structural deflections.

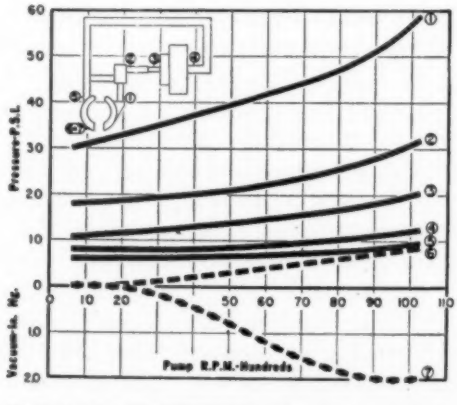


FIG 2. TO PREVENT noise, pump cavitation must be eliminated or minimized. The curves show readings at various points in the system for different pump speeds. Points 6 and 7 are at the pump suction port, 1 is pump discharge, 3 and 4 are at the power cylinder. Curve 7 was plotted without use of a flow director in the circuit. The resulting vacuum readings indicate that pump cavitation is severe. Curve 6 shows the correction.

2. Air noise was experienced due to air leaks and unsatisfactory purging of the air from the oil. In the interest of filling the pump intake port the return line ran directly to the intake port, with the reservoir "Teed" into the return line for purging air and the addition of make up oil. Use of ejectors to facilitate addition of make up oil from the reservoir defeated the purging of air. The only satisfactory arrangement, as regards purging of the air, returned the oil to the reservoir for a dwell before going to the intake port.

3. Cavitation noise was experienced on the initial installation at pump speeds above 2500 rpm. Cavitation speed was raised to the top of the speed range where there was no noticeable noise in the passenger compartment by arranging the internal oil passages so that the return oil streams from the reservoir and flow control valve met in such a manner as to facilitate filling the pump rather than bucking each other and creating turbulence. The curves on Figure 2 show the pressure at different points in the system. Without the flow director the oil streams buck each other and cavitation is experienced, as evidenced by the vacuum at 2500 rpm speed in the intake port shown on curve no. 7. Introduction of the flow director results in a positive pressure at the inlet port and more adequate filling of the pump as evidenced by curve no. 6. With the flow director, pump delivery is almost linear up to 5000 rpm pump speed.

4. Porting changes in the cut-off point for opening and closing the inlet and outlet ports contributed to

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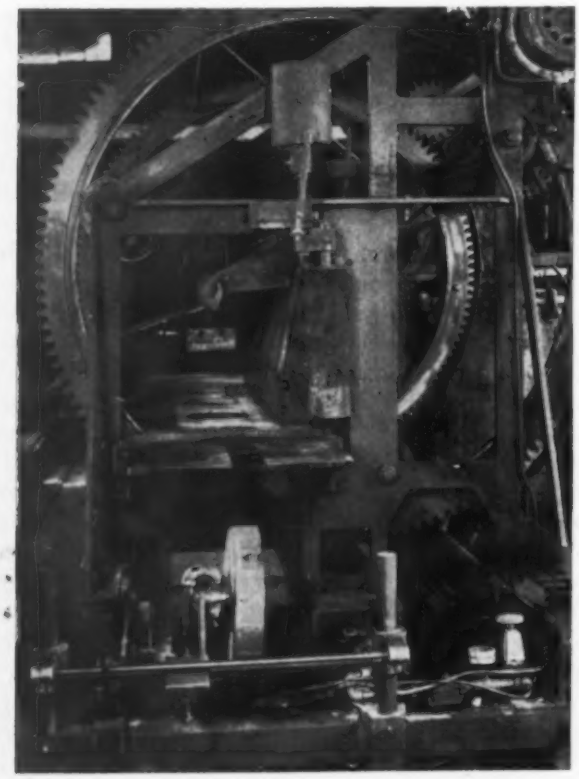
Would an Electro-pneumatic System

AN electro-pneumatic brick and tile cutter, made by Chambers Brothers Company, Philadelphia, Pennsylvania, is a high production, fully automatic machine —simple in design, easy to operate and maintain. The outstanding features of the machine are its versatility in handling multiple operating cycles on a fully automatic basis and the machine's ability to exactly match the speed of an extruded column where the linear rate of extrusion is continuously changing.

The pneumatic circuit which operates the machine is a development of some years; actually, it is the result of the evolution of a coordinated air control system. The number of valves on the present machine is fewer than on previous models, the circuit adjustments are simpler to make and the machine is easier and safer to operate.

The machine is essentially a pneumatically powered carriage in which longitudinal movement is accomplished by a pair of air cylinders, and the rotary movement is controlled by an air brake and clutch. A clay bar is extruded into the machine in a continuous column, and the actual cutting stroke is made by the rotation of the reel through a half turn, the cutting being done by wires attached to rings that revolve on the center bar or hub of the platen carrying the extruded column. Once the cutter wires for a given piece are set, the pressure reducing and flow control valves are adjusted to balance the circuit, and the cycle of operation becomes automatic.



THE CHAMBERS BRICK and tile cutter is shown from the entrance end. This unit is in the plant of National Fireproofing Company at East Palestine, Ohio. The longitudinal reel movement, the rotation for the cutting stroke are actuated by a simplified, coordinated air circuit which performs the cycle automatically.

Cycle of Operation

A clay bar to be cut is delivered to the entrance end of the machine where it contacts and actuates a measuring wheel. As the measuring wheel revolves with the clay bar, a cam operates a tripoff, poppet-type valve. This measuring wheel tipoff valve actuates a 4-way master control valve to perform four of the basic functions in the automatic cycle:

(a) On the exhaust side, the 3-way pilot valve at the brake is relieved so that the reel will be free to rotate when the clutch is engaged.

(b) On the pressure side air is released through a combination pressure reducing valve and flow control valve to the starting cylinder. This cylinder on the front end of the machine is a 1 inch stroke, single acting cylinder. Its purpose is to start the carriage travel in order to exactly synchronize the speed of the reel with the extruded column. The push of the clay bar helps to perform this function. The flow control valve bleeds air from this starting cylinder, giving an adjustable cushion for the carriage return.

(c) Air is also directed through a pressure regu-

...olve Your Machine Timing Problems?

. . . it did on this brick and tile machine where a rotating cutter is synchronized with linear extrusion speed

lating and flow control valve that can be set from zero psi to line pressure to a 13½ inch stroke air cylinder, which also helps the carriage to match the speed of the clay bar during the cutting stroke. The air flow on the return stroke is covered in the description of the second control valve.

(d) Air is directed through a hose to a cam operated blow valve. This valve opens when the carriage has moved about 2 inches, at which time the carriage is moving at clay bar speed. As the blow valve opens, air is admitted to the three-way, pilot operated valve, which operates the air clutch, mounted in a sheave and driven by a 3 hp motor which delivers the power for the rotary cutting action.

When the reel has rotated approximately one-quarter of a turn, a cam on one of the ring gears opens a second blow valve, which reverses the master valve to perform three more functions in the automatic cycle:

(a) On the exhaust side air is released from the clutch and applied to the brake. Both the clutch and brake are equipped with quick release valves which operate on a 5 psi pressure drop to insure rapid action. The flow control valve at the brake can be adjusted so that the reel stops in exactly the desired position.

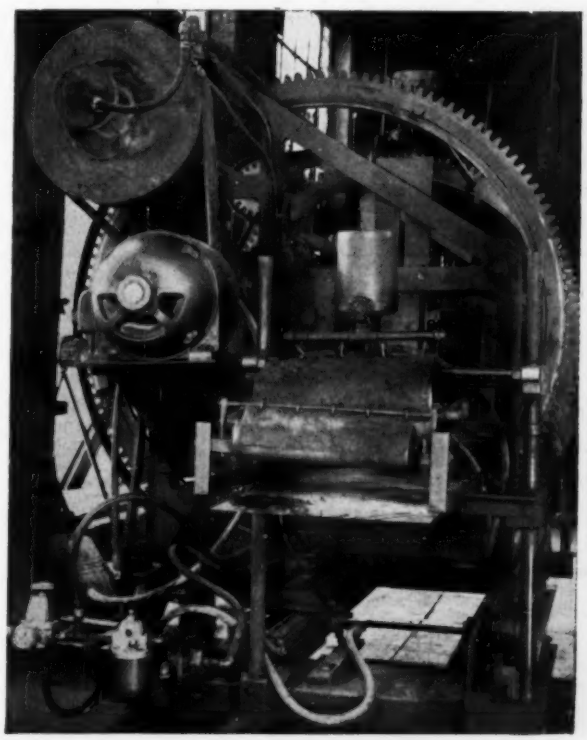
(b) On the pressure side air is applied to the brake, at which time the carriage will start to return before rotation has stopped.

(c) Simultaneously, as the master valve is reversed, air enters into the head end of the main carriage cylinder and returns the carriage to its starting position. A pressure regulating valve in the cylinder return master valve line provides back pressure to control the speed of the carriage return. The two flow control valves control the speed of the carriage return after the cut and regulate the final cushion of the carriage at its starting point.

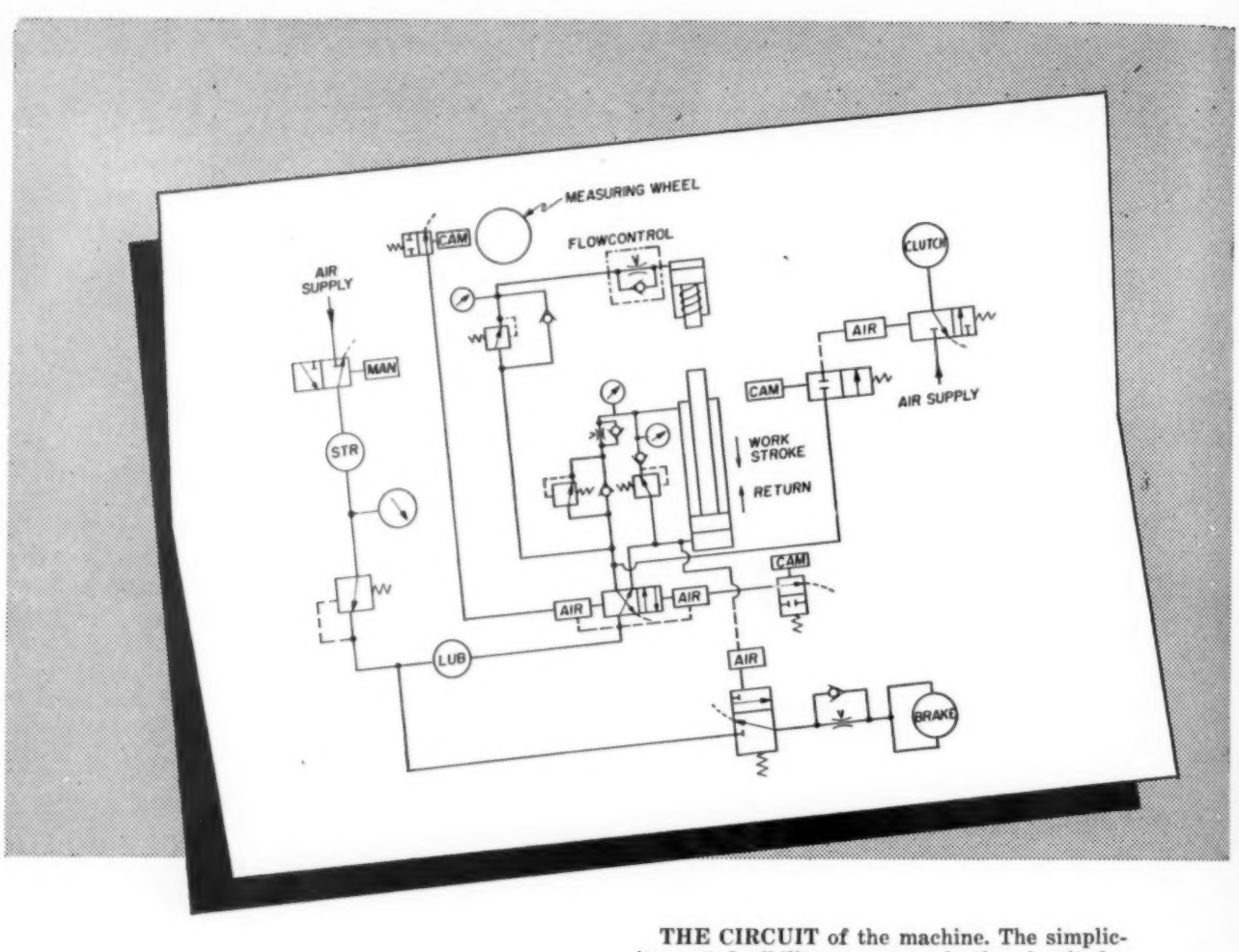
Pressure Gauges

Four pressure gauges are installed in the circuit. The first is installed in the inlet line immediately after the strainer. The system operating pressures are read on this gauge. Most cutting of brick and tile is done with pressures of 75 to 80 psi. Higher pressures can be used for heavier cuts. The shutoff valve has a port for bleeding air from the system when the pressure is off.

The second pressure gauge, in the line from the master control valve to the head of the main reel



THE EXIT END of the same machine. Most of the control system, including the master control valve and the brake are on this end.



THE CIRCUIT of the machine. The simplicity and flexibility recommends the circuit for many types of heavy duty operation.

cylinder, indicates the back pressure in the carriage cylinder during the return stroke. The third gauge is mounted in the second line from the head of the reel cylinder to the master control valve. This gauge registers the pressure during the cutting stroke. The fourth gauge shows the pressure from the pressure reducing valve supplying air to the starting cylinder.

Going to the Hydraulics Conference?

The eighth annual National Conference on Industrial Hydraulics meets in Chicago, September 4th and 5th, at the Sherman Hotel. The Conference is one of the many technical meetings being scheduled during the Centennial of Engineering. To register for the Hydraulics Conference write John G. Duba, Illinois Institute of Technology, Technology Center Chicago, Illinois.

The gauges collectively simplify the job of the operator in setting his flow control and pressure reducing valves from job to job or from material to material.

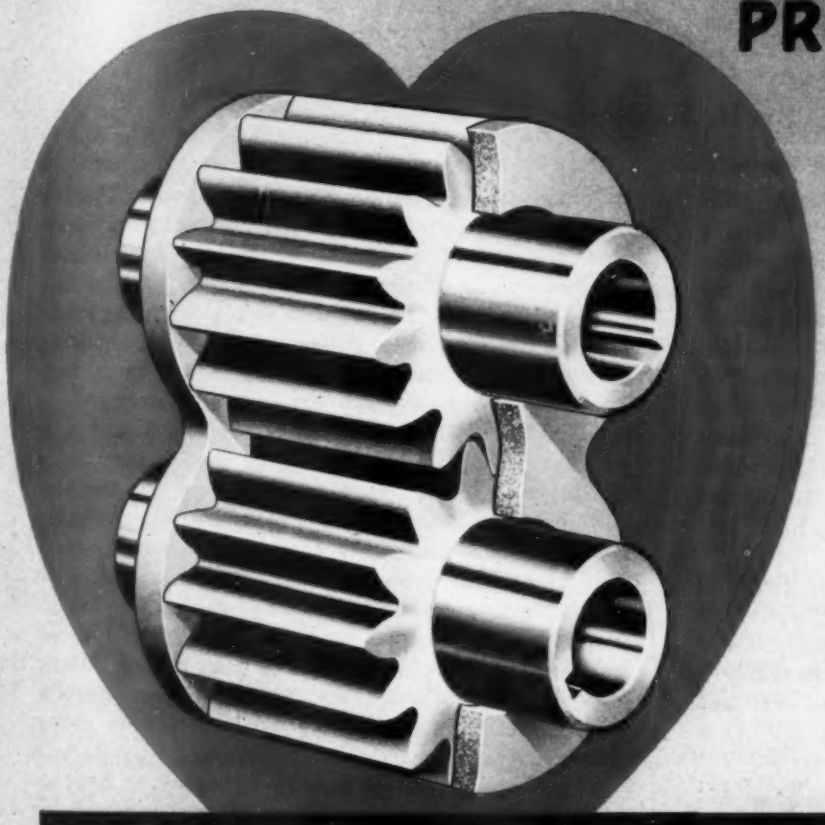
Three swinging check valves are provided; one permits air to exhaust from the main reel cylinder, another permits air to exhaust from the starting cylinder; the third prevents air from exhausting during the cutting stroke.

The clay bar supporting platen can be rapidly replaced to make any product which the plant desires. The length of the cut product is determined by the spacing of the cutting wires and matching slots in the supporting platen.

As previously mentioned, the pneumatic circuit has been a development over a number of years. This has meant that every component and combination of components in the present machine has been proven efficient and reliable by operation under many and adverse conditions. Basically, the circuit is a simple one, with no extras not essential for the functioning of an automatic cycle. The work circuit is flexible and easy to maintain.

This electro-pneumatic cutter has set a new standard of production efficiency for the clay and tile industry. In addition to its production advantages, the simplicity of setup, the ease of operation and the resulting low maintenance add up to a substantial advance in the application of pneumatics to high production, heavy duty, automatic equipment.

"COMMERCIAL" HYDRAULIC OIL PRODUCTS



The heart of all "Commercial" Hydraulic Circuits which are power operated by our continuous running pumps—feature . . .

- Hardened Alloy Steel Gears having specially developed tooth contour—with all surfaces (teeth and faces) ground to extremely close tolerances . . .
- Integral Hubs on the Gears sized for heavy duty roller bearings—thus reducing deflection and wear to a minimum . . .
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All to insure a unit that is simple in design—highly efficient in operation—built for long life expectancy at an economical (initial — operating — maintenance) cost for the user.

THE HEART OF "COMMERCIAL" HYDRAULIC SYSTEMS

• PUMPS - MOTORS . CAPACITIES: Pumps—1 to 75 G.P.M. Motors—1 to 20 H.P.
PRESSURES: Up to 1500 P.S.I.
TYPES: Single and Tandem

• VALVES . . . . . . SIZES: 1/2" and 3/4"
TYPES: Unit — Tandem — Special
CONTROL ACTIONS: Single Acting—"Three Way," Double Acting—"Four Way," Double Acting—"With Float Position"

• CYLINDERS . . . . SINGLE SLEEVE: Single Acting—Capacity up to 50 tons—Effective Sleeve Diameter 1" thru 11-1/2"
Double Acting—Capacity up to 40 tons—Effective Sleeve Diameter 1" thru 10-1/2"

MULTIPLE SLEEVE: Single Cylinder—Capacity up to 50 tons—Effective Sleeve Diameter 1-3/4" thru 11-1/2"
Twin Cylinder—Capacity up to 40 tons—Effective Sleeve Diameter 1-3/4" thru 7-7/8"
Tandem Mounting—Capacity up to 100 tons—Effective Sleeve Diameter 1-3/4" thru 11-1/2"

The COMMERCIAL SHEARING & STAMPING COMPANY
YOUNGSTOWN 1, OHIO.

Fluid Powered Chucks Increase Machining Production

By H. L. Stewart

THE challenge to keep production rates of lathe-made parts at a maximum and scrap losses at a minimum has been met by a number of ingenious production and planning departments by specifying that new production machines be equipped with power-operated chucks and that old machines be converted so that power chucking devices may be installed on them. Power chucking, by both air and oil pressure circuits, has increased production, reduced scrap losses and lowered maintenance. Machining cycles in which air powered chucks, for example, have supplanted manually-operated chucks, were reduced up to 80 percent.

"Power chucking" actually covers two types of power chucks: (1) chucks operated by a power chuck wrench and (2) chucks operated by a power-operated drawbar. The power chuck wrench is essentially a motor driven, gear reduction mechanism to open and close the jaws of a hand operated type chuck. The big advantage of the power chuck wrench is that it relieves the operator of physical strain. This type is used on short and on medium production runs.

The power-operated drawbar chuck, used for medium and long production runs, consists of a chucking device, a chuck adapter if the spindle nose is non-standard, a rotating cylinder adapter, drawrod to connect the rotating cylinder to the chuck and a 4-way control valve. The chucking device may be a chuck, collet or a mandrel, depending on the size and shape of the work piece. Standard power chucks are designed in universal, combination and serrated-jaw types. Many special designs are available, such as the finger-type chueks, which are now playing an important part in the jet engine program, and the indexing type chucks for holding complicated fittings. Many builders of automatic and semi-automatic production machines design for and incorporate power chucking equipment in their equipment.

The rotating cylinder may be either air or hydraulically operated. Rotating cylinders are designed for

H. L. STEWART, Logansport Machine Company, Logansport, Indiana.

FIG. 1. HEAD STOCK of a Lodge & Shipley Company lathe with air operated chucking and tool holder mounted on the rod end of a conventional air cylinder.

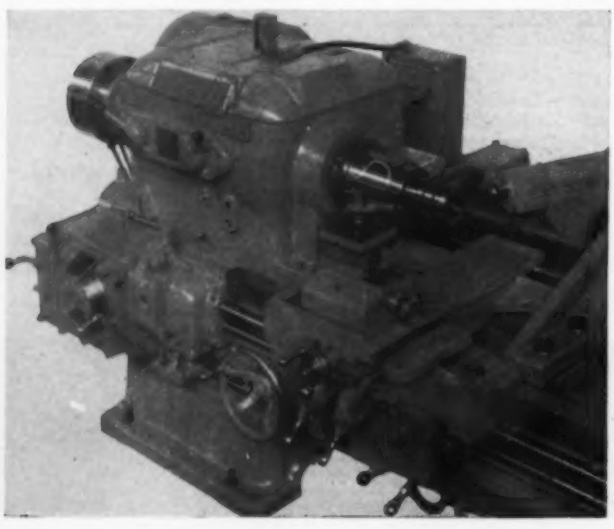
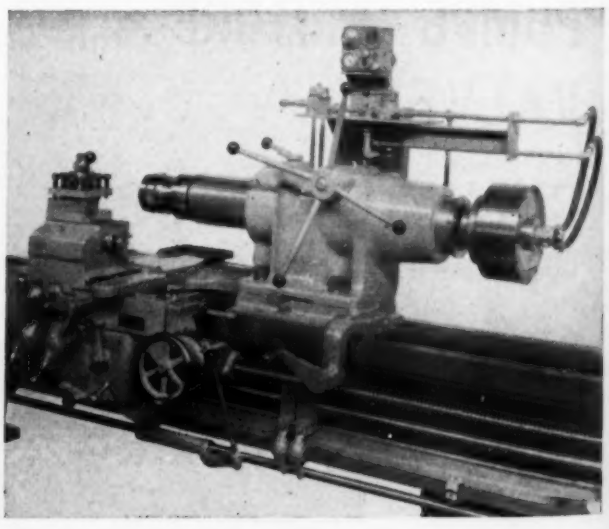


FIG. 2. TAILSTOCK of the same lathe with air operated chucking. The power chucking on both ends of this lathe increased production 400 percent.



Power chucking, by both air and oil pressure circuits, has increased production, reduced scrap losses and lowered maintenance. The choice between air or oil involves the consideration of weight, holding force, plant compressor capacity and the location of chucking equipment.

closed distributor shafts for high speeds or hollow distributor shafts for bar stock or coolant feed.

The control valve may be hand, foot or electric power operated, depending largely on the application. If air is the power source, a suitable filter, regulator and lubricator unit must be used.

Some machines are designed with two complete sets of basic chucking equipment, one for the headstock and one for the tailstock. Other arrangements are for the basic equipment to be mounted on the headstock, an air-operated tailstock and air, airdraulic or hydraulic-operated feeds.

Air Chucks Widely Used

Air is used more commonly than oil, since it is easier to pack the rotating joint for air than for oil. However, in making a choice of air or hydraulic power, a number of factors are taken into consideration.

First, and most important consideration is the weight of the equipment on the spindle. With heavy cuts and high-speed cutting tools on rough forgings and castings, very heavy gripping pressures must be applied. This means a large air cylinder or a smaller hydraulic cylinder at higher pressure. The small, lighter hydraulic cylinder can impart the same pressure as the larger, heavier air cylinder, thus reducing the weight on the spindle bearings. For example, a 16 inch air cylinder operating at 80 psi gives a drawbar thrust of 16,000 pounds; an 8 inch hydraulic cylinder operating at 350 psi gives a drawbar thrust of 18,000 pounds. The 16 inch cylinder weighs 170 pounds, the 8 inch cylinder only 100 pounds. This does not include the weight of the cylinder adapter, which will be considerably lighter for the smaller cylinder. Guard clearances on the machine may also definitely favor the smaller cylinder.

Second the installation cost of a hydraulic circuit may be lower than the air, if the additional air requirement will overload the compressor capacity. This advantage permits several machines and their circuits to be operated.

A third consideration that may favor an oil circuit over an air circuit is the location of the chucking equipment. If the equipment is remotely located from

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FIG. 3. AN AIR CHUCK on this lathe is holding a torque converter stator assembly which must be held without distortion and machined to close limits.

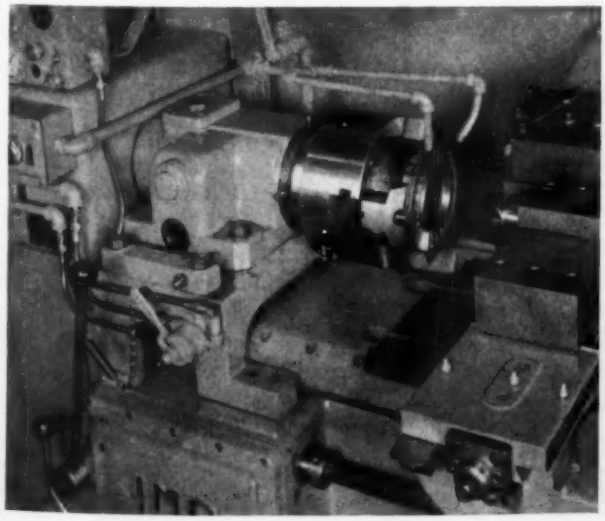
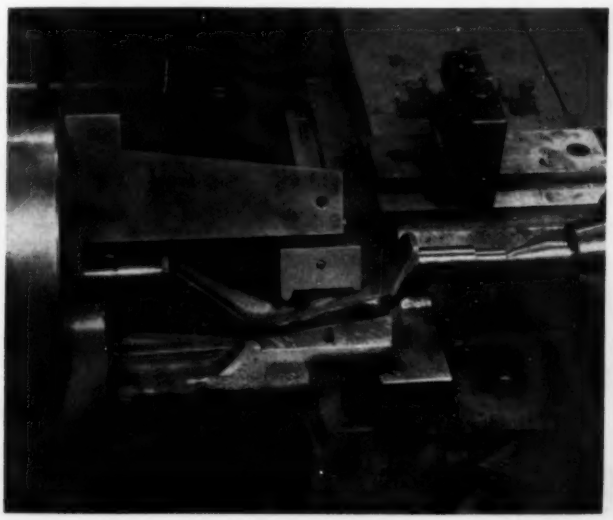
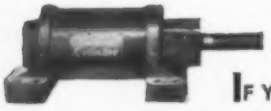


FIG. 4. AN AIR CHUCK on this Monarch Machine Tool Company machine is equipped with a special nesting fixture to hold an irregular work piece.



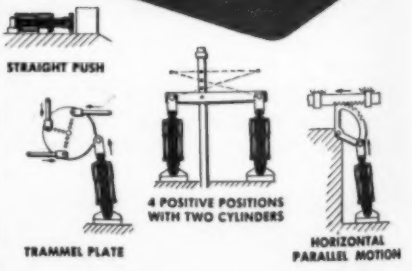
...how can I use HANNA® cylinder power in my machine tools and equipment?

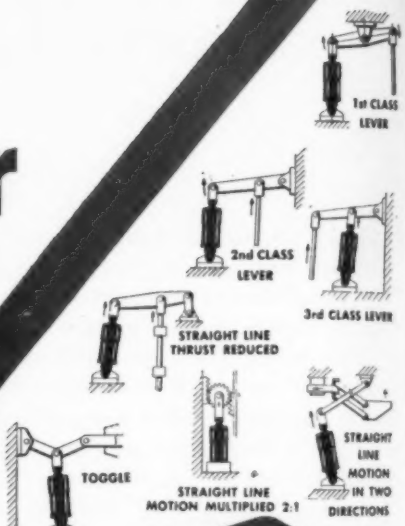


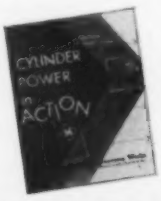
IF YOU HAVE a push, pull, lift, press, clamp or control problem, Hanna Cylinder Power can be the answer. The mechanical movements here illustrated may suggest ways Hanna Cylinders can be used to simplify the actuation and control of machines or equipment and to replace or reduce manual effort.

In the majority of cases, you can select a standard cylinder model to meet your specific requirements from the broad Hanna Hydraulic and Pneumatic lines. Regardless of whether you choose a "standard" or "special" the Hanna label assures you of quality developed through fifty years of concentration on cylinders and their control valves!

here are basic Cylinder Powered MECHANICAL MOVEMENTS that can be put to work for YOU!







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The new Bulletin "Cylinder Power in Action" illustrates 16 cylinder powered movements and shows 21 actual application photos. Write for Bulletin 255.

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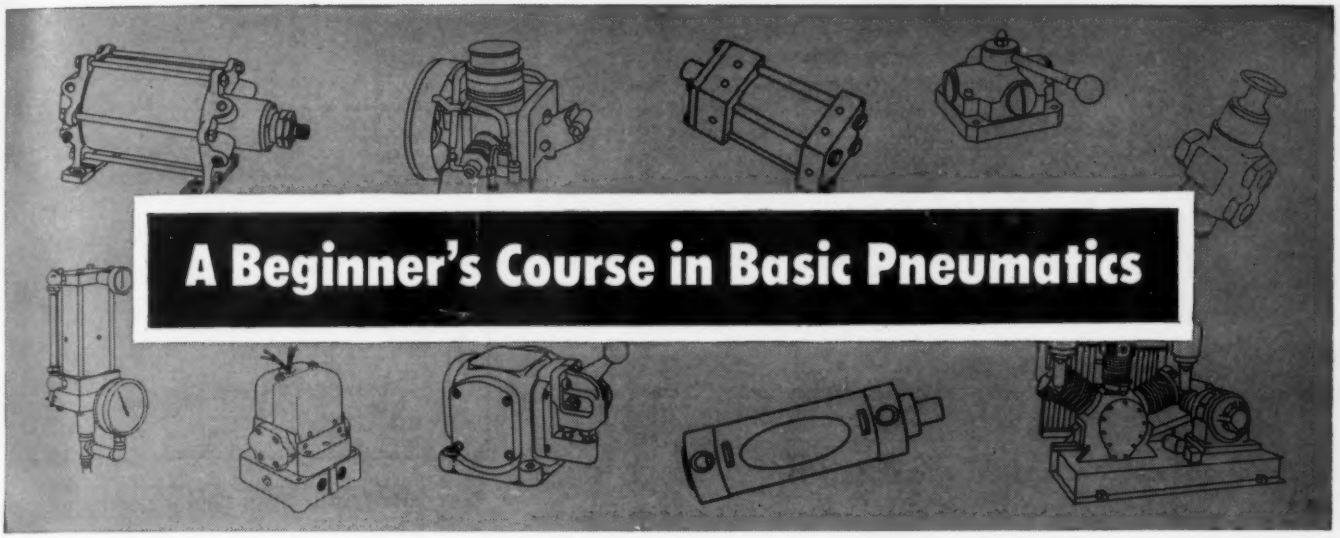
HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS



A Beginner's Course in Basic Pneumatics

Section I

Air Properties and Characteristics

Part VII

The "Efficiencies" and What They Mean

EFFICIENCIES in air work are ratios of input to output or the ratio of energy expended to the useful work performed. We are concerned with a group of efficiencies—compression, compressor, mechanical, slippage, overall and volumetric—which we will discuss in turn. The first three are the subject of this article; the second three, with the emphasis on volumetric efficiency, will be the subject of next month's article.

As an introduction to our "efficiencies" we will review several definitions that will be helpful.

Theoretical horsepower is the horsepower required to adiabatically compress air or any gas delivered by the compressor through a specific range of pressures. As the name implies it is that horsepower, which is required to do work on the air and does not include that additional horsepower required to overcome mechanical or other losses. Figure 1, which we will use later, lists the theoretical horsepower required to compress air at a rate of 100 cubic feet per minute from atmospheric to a range of discharge pressures. Values for both isothermal and adiabatic compression are given.

Compressor brake horsepower is the energy supplied by the prime mover (electric motor or gas engine) to run a compressor. In addition to the power required to compress the air or gas in the cylinder, friction in cylinder ports, valve losses and other mechanical losses are included. For this reason brake horsepower for any displacement compressor varies with the compression ratio and with the absolute intake and discharge pressures. Brake horsepower is the total power required to operate a given compressor under a given set of conditions.

Figure 2 gives brake horsepower for 100 cubic feet of free air delivered per minute. For example, at sea level 22.1 b.h.p. are required to compress 100 cubic feet of free air per minute to 100 psi gauge (single stage); at an altitude of 5000 feet, 20.3 b.h.p. will do the same work. At 5000 feet, 17.9 b.h.p. would deliver 100 cubic feet at 80 psi gauge or 100 cubic feet at 100 psi gauge at 12,000 feet.

Air indicated horsepower or *indicated horsepower* is the actual furnished or delivered horsepower as calculated or determined from compression indicator diagrams.

The *mean effective pressure*, determined normally from a compression indicator card, is that pressure which, when multiplied by the piston displacement will give the work inside the cylinder. The work in

foot pounds when divided by 33,000, will give the indicated horsepower.

Indicated horsepower may readily be calculated when the mean effective pressure is known. The formula for indicated horsepower is

$$\text{i.h.p.} = \frac{\text{m.e.p. LAN}}{33{,}000}$$

in which L = Length of stroke of piston in feet
A = Area of piston in square inches
N = Number of effective strokes per minute
m.e.p. = Mean effective pressure in psi (33,000 foot pounds = one horsepower)

Since $\frac{LAN}{144}$ = piston displacement (PD) in cfm,

the formula becomes $\text{i.h.p.} = \frac{\text{m.e.p. x PD x 144.}}{33{,}000}$.

If PD is 100 cfm, i.h.p. per 100 cfm of piston displacement per minute, the formula simplifies to

$$\frac{\text{m.e.p. x 100 x 144}}{33{,}000} = \frac{\text{m.e.p.}}{2.292}$$

It is not necessary to know the total horepower of the compressor to obtain compression efficiency so long as the mean effective pressure in the air cylinders is known. The formula, i.h.p. = m.e.p./2.292, always stated for 100 cfm of piston displacement per minute, is true for any cylinder or piston, whether air compressor, gas or steam engine, pump, etc. For gas engines only, the piston displacement of the working stroke only should be included.

The computation for m.e.p. is rather involved and since the data is available in tabular form, Figure 1, we will use the value in the table for determining compression efficiencies.

The first of our "efficiencies" is *compression efficiency*. Compression efficiency is the ratio of theoretical horsepower to the indicated horsepower. The latter, as we have stated above, is the actual po delivered by the compressor or brake horsepo minus mechanical losses.

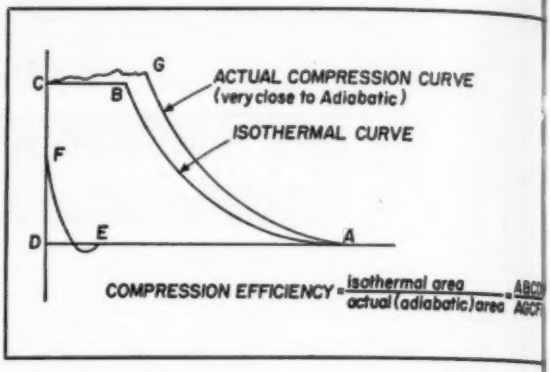


FIG. 2. Indicator diagram for determining compress efficiency.

Compression efficiency may be classed as *isother compression efficiency* or as *adiabatic compress efficiency*, depending on whether the theoretical ho power is based upon isothermal or adiabatic co pression. If based on isothermal compression, efficiency is known as *isothermal compression e ciency*.

For example, a compressor is delivering 1500 c of "free" air at atmospheric temperature and pr sure, compressed to 100 psi gauge. Calculation indicator diagram gives a required 229 indica horsepower in the air cylinder. The barometer re ing is standard, 29.92 inches. With the aid of Ta 1 we can compute the isothermal compression e ciency.

The i.h.p. for 1500 cfm is
229/15 = 15.26 per 100 cfm. Enter Table 1

Discharge Pressure			Isothermal Compression Single or Multi-Stage		Adiabatic Compression*				Theoretical Intercooler Gage Pressure	Per Cent of Power Saved by Two-Stage over Single Stage Adiabatic Compression
					Single Stage		Two-Stage			
Lbs. per Sq. In., Gage	Lbs. per Sq. In., Absolute	Atmospheres Absolute	M.E.P.	Theoretical Hp. per 100 C. Ft.	M.E.P.	Theoretical Hp. per 100 Cu. Ft.	M.E.P., Lbs. per Sq. In. referred to Low-Press. Air Cyl.	Theoretical Hp. per 100 Cu. Ft.		
5	19.7	1.34	4.13	1.8	4.48	1.96	.....	.....	.....	.....
10	24.7	1.68	7.57	3.3	8.21	3.58	.....	.....	.....	.....
15	29.7	2.02	10.31	4.5	11.4	5.0	.....	.....	.....	.....
20	34.7	2.36	12.62	5.5	14.3	6.2	.....	.....	.....	.....
25	39.7	2.70	14.68	6.4	16.9	7.4	.....	.....	.....	.....
30	44.7	3.04	16.30	7.1	19.2	8.4	.....	.....	.....	.....
35	49.7	3.38	17.90	7.8	21.4	9.3	.....	.....	.....	.....
40	54.7	3.72	19.28	8.4	23.4	10.2	.....	.....	.....	.....
45	59.7	4.06	20.65	9.0	25.2	11.0	.....	.....	.....	.....
50	64.7	4.40	21.80	9.5	27.0	11.8	.....	.....	.....	.....
55	69.7	4.74	22.95	10.0	28.7	12.6	.....	.....	.....	.....
60	74.7	5.08	23.90	10.4	30.3	13.3	.....	.....	.....	.....
65	79.7	5.42	24.80	10.8	31.9	13.9	.....	.....	.....	.....
70	84.7	5.76	25.70	11.2	33.3	14.6	29.2	12.8	20.6	12.3
75	89.7	6.10	26.62	11.6	34.7	15.2	30.3	13.3	21.6	12.5
80	94.7	6.44	27.52	12.0	36.0	15.7	31.3	13.7	22.7	12.7
85	99.7	6.78	28.21	12.3	37.3	16.3	32.3	14.1	23.6	13.5
90	104.7	7.12	28.93	12.6	38.6	16.9	33.2	14.5	24.5	14.2
95	109.7	7.46	29.60	12.9	39.8	17.4	34.2	14.9	25.5	14.4
100	114.7	7.80	30.30	13.2	40.9	17.9	35.0	15.3	26.3	14.5

*Based on a value for n of 1.3947.
From Compressed Air Data

FIG. 1. Mean effective pressure and theoretical horsepower.

the isothermal factor for 100 psi gauge and standard barometer. We find factor 13.2 for theoretical horsepower. The isothermal compression efficiency is

$$\frac{13.2}{15.26} = 86.6 \text{ percent}$$

At barometric pressures below standard and with the same quantity of free air, the indicated horsepower is less at the same efficiency of compression. At barometric pressures above standard, the indicated horsepower is more for the same efficiency of compression. In other words, the barometric readings are a factor in the power required for a given efficiency of compression.

Adiabatic Compression Efficiency

If the theoretical horsepower is based on adiabatic compression, the efficiency is known as *adiabatic compression efficiency*. We can illustrate with an example. Assume an i.h.p. per 100 cubic feet of delivered air per minute by single stage compressor is 14.5. Enter Table 1 under the single stage adiabatic column. At 100 psi gauge discharge pressure the theoretical horsepower factor is 17.9. The adiabatic compression efficiency is

$$\frac{14.5}{17.9} = 81.0 \text{ percent.}$$

The second of our efficiencies, *compressor efficiency* (adiabatic) is the ratio of the theoretical horsepower to the brake or shaft horsepower. It is compression efficiency times mechanical efficiency.

Mechanical efficiency is the ratio of indicated horsepower to the brake horsepower for a power driven machine. Written as a simple formula, mechanical efficiency = i.h.p./b.h.p.

The next installment will discuss slippage efficiency, overall efficiency and volumetric efficiency.

Adiabatic compression efficiency: the compression efficiency when such efficiency is based on adiabatic compression.

Brake Horsepower: (or shaft horsepower) the input horsepower to the compressor. This is the total input and represents total of indicated horsepower plus mechanical losses.

Compression efficiency: the ratio of theoretical horsepower to the indicated or delivered horsepower. The latter is the brake power minus the mechanical losses.

Compressor efficiency: the ratio of the theoretical horsepower to the brake or shaft horsepower. It is equal to the compression efficiency times the mechanical efficiency.

Indicated horsepower or **air indicated horsepower:** actual or delivered horsepower as calculated or determined from compression indicator diagram.

Isothermal compression efficiency: the compression efficiency when such efficiency is based on isothermal compression.

Mean effective pressure: the pressure which, when multiplied by the piston displacement, will give the work within the cylinder. The work, in foot pounds when divided by 33,000 will give indicated horsepower.

Mechanical efficiency: the ratio of indicated horsepower to the brake horse power for a power driven machine.

Theoretical horsepower: the horsepower required to adiabatically compress air or any gas delivered by the compressor through a specific range of pressures.

Figures given are bhp. per 100 cu. ft. of free air per minute actually delivered.

ALTITUDE FEET	SINGLE STAGE			TWO-STAGE			
	Lbs. per Square Inch Gage			Lbs. per Square Inch Gage			
	60	80	100	60	80	100	125
0	16.3	19.5	22.1	14.7	17.1	19.1	21.3
1,000	16.1	19.2	21.7	14.5	16.8	18.7	20.9
2,000	15.9	18.9	21.3	14.3	16.5	18.4	20.5
3,000	15.7	18.6	20.9	14.0	16.1	18.0	20.0
4,000	15.4	18.2	20.6	13.8	15.8	17.7	19.6
5,000	15.2	17.9	20.3	13.5	15.5	17.3	19.2
6,000	15.0	17.6	20.0	13.3	15.2	17.0	18.8
7,000	14.7	17.3	19.6	13.0	14.9	16.6	18.4
8,000	14.5	17.1	19.3	12.7	14.6	16.2	18.0
9,000	14.3	16.8	18.9	12.5	14.3	15.9	17.6
10,000	14.1	16.5	18.6	12.3	14.1	15.6	17.2
12,000	13.6	15.9	17.9	11.8	13.5	15.0	16.5
14,000	13.1	15.2	17.2	11.3	12.9	14.3	15.7

*Note:—Brake horsepower per 100 cu. ft. of free air per minute will vary considerably with the size and type of compressor.

From Compressed Air Data

FIG. 3. Approximate brake horsepower required by air compressors at varying altitudes.

What's NEW in useful Free literature

To get your reference copies use the postcard bound in this issue.

SILICONE LUBRICANT . . . Data Sheet VSA1 issued by the Dow Corning Corporation outlines Valve Seal A which is used as a lubricant for pressure lubricated valves and flow meter bearings operating at temperatures from −40 to over 500 F. Also featured in this data sheet are tables evaluating the performance of Value Seal A in over 120 different chemical and gas services.

Circle 201 on Reader Service Card

SAFETY RELIEF VALVE . . . Bulletin 290 describes the new safety relief valve type F 51, which has been manufactured by A. W. Cash Valve Manufacturing Company. Dimensions and features of this valve are listed.

Circle 202 on Reader Service Card

TORQUE CONVERTER . . . Torcon Corporation has issued a new 4 page illustrated Bulletin No. TC 639, describing heavy duty automatic hydraulic torque converters. Shown in the catalog are the three elements of the unit, pump, turbine and reaction member. Advantages listed are increased output through maximum utilization of engine horsepower, versatility of application, reduced maintenance on all driving and driver mechanisms and reduced operator fatigue.

Circle 203 on Reader Service Card

FLEXIBLE COUPLING . . . Construction features enabling this coupling to withstand pressures in excess of 375 psi and temperatures from minus 65 degrees to plus 160 degrees on fuel and oil lines, are described in a new folder offered by E. B. Wiggins Oil Tool Co., Inc. Also available is a folder describing a breakaway coupling carrying fluid or oxygen lines. The coupling has been pressure tested to 750 psi and uses any standard insert.

Circle 204 on Reader Service Card

OIL REFINER . . . Unit which is economical and efficient is detailed in Bulletin YM 60, Walter Kidde & Company, Inc., Youngstown Miller Div. By restoring oil to peak performance levels the refiner can protect machinery, curb costly shutdowns and reduce repair bills. The various models are illustrated and sectional operating drawings shown.

Circle 205 on Reader Service Card

AIRHYDROPUMP . . . A brochure, List No. A-3, describing single acting and double acting Airhydropumps has been published by Charles S. Madan & Co., Ltd. This pump produces hydraulic pressure, variable within limits by means of a small volume of compressed air, which is available in all up-to-date plants at pressures from 30 to 100 psi. Types are listed to give ratio of air to hydraulic pressures as low as 1 to 2½ and as high as 1 to 272 resulting in pressure range from 15 to 27,000 psi. Both types of pumps, of which 34 standard models are available are illustrated.

Circle 206 on Reader Service Card

ALUMINUM FITTINGS . . . Parker Appliance Company has issued a four page Bulletin 4316 B-2 describing their new line of aluminum Triple-lok fittings in the popular medium sizes. The advantages of aluminum plus the Triple-lok design are outlined. Illustrated are the various shapes which are available, such as male and female connectors, elbows, unions, tees and tube end reducers for ¼, 5/16, ⅜ and ½ in. tube o.d., and applications.

Circle 207 on Reader Service Card

AIR AND HYDRAULIC VALVES . . . Bulletin 1000 just published by the Ledeen Manufacturing Co. describes valves to operate air and hydraulic cylinders and motors. Hand valves, foot valves, pilot operated valves and pilot operating valves are all illustrated, flow cycles, dimensions and weights and symbols are given, also included are a series of circuit diagrams using these valves. Part of this 16 page bulletin is devoted to accessories such as filters, vitalizers and lubro-control units.

Circle 208 on Reader Service Card

ELECTRIC CONTROLS . . . General Electric Co. has issued illustrated Catalog GEA 5781, describing starters, controls, devices and accessories. This 8-page condensed catalog will assist you in selecting limit switches, solenoids relays and timers for the control of hydraulic and pneumatic systems.

Circle 209 on Reader Service Card

HYDRAULIC FILTER . . . A folder which describes hydraulic filters, designed for the positive filtration of all industrial and fuel oils, solvents and water, has been published by Alsop Engineering Corp. Transfer, pump units tanks and mixers are also shown.

Circle 210 on Reader Service Card

MANOMETERS . . . King Engineering Corporation offers a new 12 page manual on manometers. The booklet which is well illustrated, describes basic facts and definitions on pressure measurement. Explained are how various types of manometers operate and what they measure. Information on installation, operation and maintenance are detailed. English and metric tables of equivalents are given for manometer readings, taken with various indicating liquids, together with temperature correction factors and instructions on how to use them.

Circle 211 on Reader Service Card

MECHANICAL TUBING . . . The many advantages that accrue to manufacturers through the use of tubing in the production of hollow precision parts are outlined in a data card issued by the Tubular Products Division of the Babcock and Wilcox Co. The bulletin also presents tables and mechanical properties of such tubing.

Circle 212 on Reader Service Card

BALL BEARINGS . . . 120 different types and sizes of miniature ball bearings are specified in a new Catalog 52B, issued by the Miniature Precision Bearings, Inc. All bearings are completely ground, honed, lapped or burnished in accordance with highest quality practice for optimum operating characteristics. In addition to this catalog, engineering data sheets, covering load ratings, clearances, tolerances and bearing installations are available.

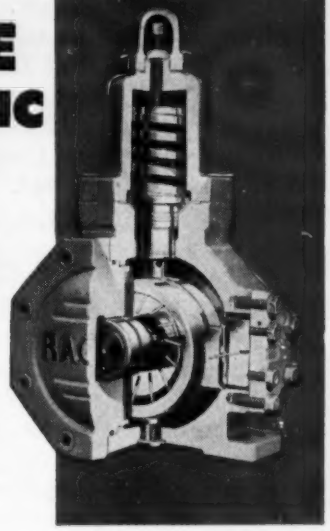
Circle 213 on Reader Service Card

TACHOMETERS . . . Principle of operation of hand, portable and fixed installation tachometers is described in a 4 page technical data sheet No. T-4 issued by the Metron Instrument Co. Simplified circuit diagrams along with illustrations of many available models are included.

Circle 214 on Reader Service Card

RACINE HYDRAULIC PUMPS

Simplify your Circuit



Less valves and controls in a circuit provide easier installation and lower initial costs.

RACINE "Variable Volume" Pumps eliminate relief valves and extra piping. They reduce horsepower requirements and avoid excessive heat losses. Over-all cost of motor and reservoir is usually reduced. Efficiency is high because RACINE Pumps "put all of the oil to work."

A wide range of governor controls provide pumping action at the proper pressure and volume to handle any given job most effectively. These interchangeable governors are an exclusive RACINE feature.

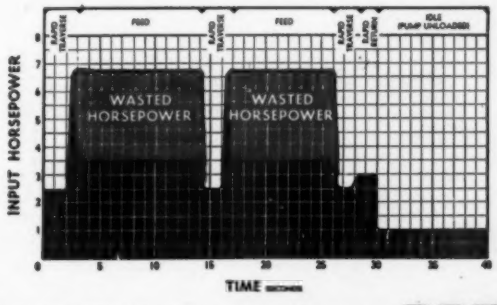


Chart above illustrates power consumption on a typical machine tool. Black area is power used with a No. 2 RACINE "Variable Volume" pump controlled by a pressure compensated feed valve. Area in color is power wasted by a constant volume pump, bypassing most of its volume through a relief valve during the feeding cycle.

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RACINE HYDRAULICS & MACHINERY Inc.

HYDRAULIC POWER UNIT . . . Power units with single pumps and with two pumps for separate circuits are discussed in catalog section 400, offered by the Rivett Lathe & Grinder, Inc. The units with single pump are designed to provide a steady flow of oil at continuous working pressure up to 1000 psi. Construction details and dimensions are furnished.

Circle 215 on Reader Service Card

AIR FILTERS AND LUBRICATORS . . . CCA Products Division of Breco Manufacturing Co. has issued a 16 page catalog featuring air line equipment. Efficient regulation of compressed air, accurate regulation of pressure from line to desired pressure, correct lubrication of tools and machinery and simplified maintenance are described. All units are illustrated and specifications given, also included are parts and price lists.

Circle 216 on Reader Service Card

HYDRAULIC POWER UNITS . . . A new 8 page Catalog 101 has been published by the Hydraulic Power Equipment Co. Described are several of their hydraulic power units. Design features of this series of power units are based on requests from steel plant engineers, whose experience has shown prevailing conditions, for their service are different from ordinary hydraulic installations on machine tools and presses. These features are detailed and working dimensions are given to assist in fitting the equipment. The different series of units are well illustrated with all specifications shown.

Circle 217 on Reader Service Card

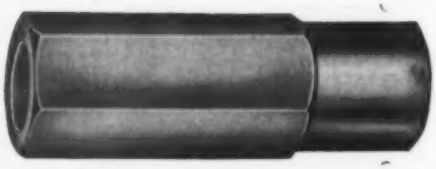
AIR VALVES . . . A new 8 page bulletin has been issued by the Beckett-Harcum Company, covering their line of Hi-Cyclic air and hydraulic operating valves. The air valve operates on a slight by-pass of lubricated air, which floats the piston, making possible extremely fast, effortless action with no lag time. The bulletin illustrates and describes the various models, showing engineering drawings and specifications.

Circle 218 on Reader Service Card

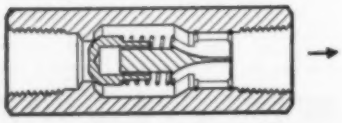
FLEXIBLE COUPLINGS . . . Couplings covering a range of horsepower from 25 hp up to 500 hp at 100 rpm and which are adaptable to practically every application where a flexible connecting medium is required, have been detailed in Catalog F24 issued by Charles Bond Company. The literature shows several types, together with sizes, dimensions and ratings and a complete buyers guide.

Circle 219 on Reader Service Card

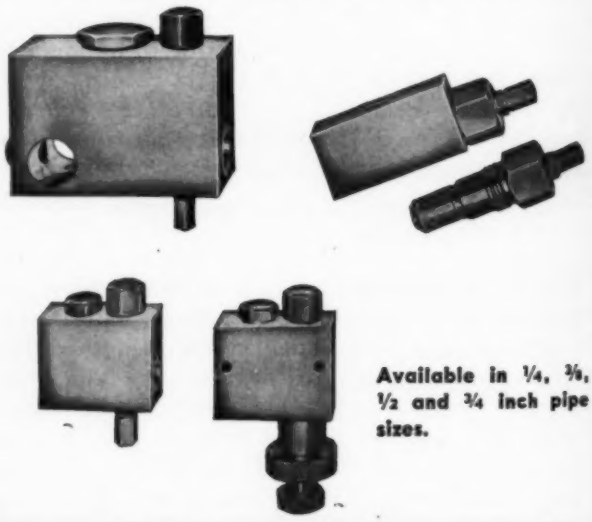
CHECK VALVES FOR OIL



Available in ¼, ⅜, ½ and ¾ inch pipe sizes.



RELIEF VALVES FOR OIL



Available in ¼, ⅜, ½ and ¾ inch pipe sizes.

- LOW PRESSURE DROP
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  No Gaskets To Leak
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- ECONOMICAL
- CONSTANT PRESSURE (Adjustable)
- SILENT (No Whistle or Chatter)
- LOW COST

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FLUID CONTROLS, INC.

Box 186B Willoughby, Ohio

NONFLAMMABLE HYDRAULIC FLUID FOR AIRCRAFT . . . Monsanto Chemical Company has issued an attractive 20 page catalog describing Skydrol, a nonflammable type hydraulic fluid. All general properties of this fluid are detailed as well as characteristics. Showing how Skydrol extends the service life of pumps, wear test data analyses are given. Many other features are also outlined and well illustrated.

Circle 220 on Reader Service Card

GENERAL PURPOSE MOTORS . . . Construction features, ratings and dimensions of open drip-proof and splash-proof squirrel cage induction motors in ratings of ½ to 100 horsepower are described in new Bulletin 51B6210D, released by the Allis Chalmers Manufacturing Co. The motors are available with many special modifications such as totally enclosed, vertical mounting, flange mounting and multi-speed construction.

Circle 221 on Reader Service Card

COMBINATION OF METALLIC AND PLASTIC PACKING . . . A desirable packing to have about the plant, providing flexible lubricated metallic and semi-metallic spirals for meeting average stuffing box requirements, is described in new Bulletin No. 443 issued by the Durametallic Corporation. This handy-pack package of general purpose packing, consists of a convenient combination of metallic and plastic spiral packings, ready for packing into stuffing box rings. The bulletin is well illustrated and designations of types are shown, as well as other products manufactured by the company.

Circle 222 on Reader Service Card

TEMPERATURE RESISTANT O-RINGS . . . A 4 page Catalog 5160A1 prepared by the Parker Appliance Company, describes and gives complete data and dimensions for precision O-rings molded for extreme temperature resistance. They offer superior resistance to extremely low or high temperatures or dry heat in non-moving seal service with air, gases, oil and many solvents and chemicals.

Circle 223 on Reader Service Card

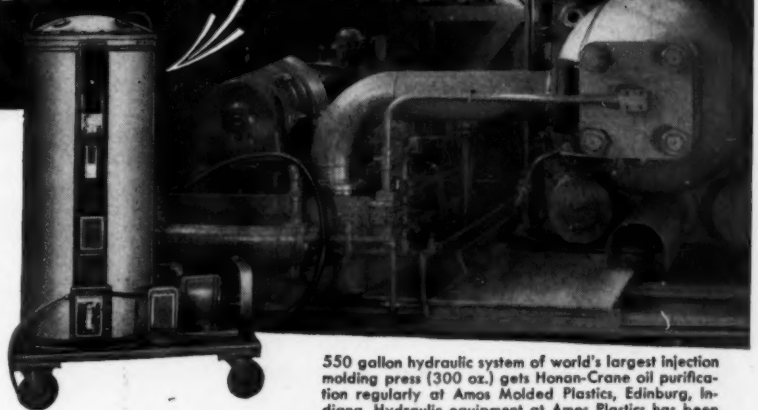
3000 PSI SOLENOID VALVES . . . The complete new line of Shear-seal solenoid valves, shut-off, 2-way diverter, 3-way selector and 4-way selector, is covered in a new Catalog, IB-2 published by Barksdale Valves, which describes and illustrates the shear seal principle. Valves for air, water and oil service come in three groups of pressure ranges, 0-250 psi, 0-1500 psi and 0-3000 psi.

Circle 224 on Reader Service Card

STOP downtime, costly repairs on HYDRAULIC EQUIPMENT

with World-Famous

HONAN-CRANE oil purification



550 gallon hydraulic system of world's largest injection molding press (300 oz.) gets Honan-Crane oil purification regularly at Amos Molded Plastics, Edinburg, Indiana. Hydraulic equipment at Amos Plastics has been protected by Honan-Crane Purifiers since 1942.

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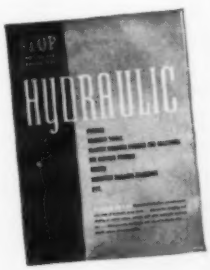

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Aircraft Pneumatic Systems

Part I

By H. R. Haerle

During recent years the growing interest in aircraft pneumatics has led to the publication of numerous technical articles dealing with various aspects of the subject. Because of the limited practical experience in this field, such articles necessarily have dealt with theoretical considerations primarily. This article outlines the growth of pneumatic systems in Great Britain during the past decade and discusses current trends in development.

CERTAIN advantages of compressed air which have been proved in practice merit special emphasis. One such advantage is that, in the majority of installations, the pneumatic system is considerably lighter than the equivalent hydraulic or electric system; this advantage will become more marked when nonflammable fluids are used because of the higher specific weights of such fluids. A further advantage, one likely to become increasingly important, is the integration of high and low pressure pneumatics with turbine engines. This point will be discussed in greater detail later.

Immediately prior to the last war, the majority of British Service aircraft were equipped with low pressure air systems employing air stored at 300 psi for the operation of wheel brakes and gun firing apparatus. In order to obtain improved performance at normal operating altitudes, a two-stage compressor was introduced and became standard equipment on practically all Service aircraft. The pressure was increased to 450 psi; although pneumatic gun firing and cocking was ultimately replaced by electrical means, the use of air was extended to include various auxiliary services such as radiator flap and hot and cold air intake control.

From the experience gained on these relatively simple systems, which were employed in very large numbers throughout the war, it became apparent that the pneumatic system was capable of development for such applications as operating wing flaps and undercarriages, in addition to wheel brakes. The limited time available for development made it desirable to avoid any large increase in system pressure; it was convenient to establish the system pressure at 600 psi. Subsequent developments have raised this to 1000 psi and many hundreds of aircraft employing one or other of these systems are flying all over the world.

Compressor Design

The rate of development of aircraft pneumatics has been governed by the progress of compressor development, since the latter is the most important item in the system and it is the steady improvements in compressors which have made advance possible. Until comparatively recently aircraft compressors have been driven by the engine at approximately half engine speed. i.e., 1200 to 1500 rpm normal cruising. Some

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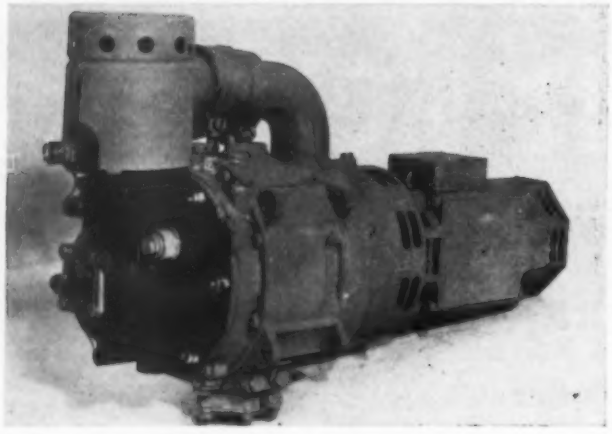

FIG. 1. AN EARLY MODEL 1000 psi compressor for aircraft use; the unit is motor driven through a reduction gear. While very satisfactory life expectancy is achieved, the unit represents a severe weight penalty.

are mounted directly in the engine. However, the usual practice is to fit compressors on an engine driven gear box which carries other auxiliaries such as hydraulic pumps, generators and vacuum pumps. There are also a small number of installations in which the compressors are driven by electric motors through a reduction gear. While these have the advantage that the compressor can be stopped after the requisite storage pressure has been reached, thus prolonging its service life, there is a severe weight penalty. A typical unit of this type is shown in Figure 1.

The tendency to increase engine speeds and, in the case of turbine engines, to cruise at a high percentage of maximum speed, has raised a number of difficulties in compressor development. A large proportion of the power absorbed by a compressor is converted to heat and the problem of heat dissipation is probably greater than any other problem encountered in compressor work. The necessity for reducing size and weight to a minimum while providing adequate life and smplicity in servicing has to a large extent dictated the general form which aircraft compressors should take. For these reasons, it has proved impracticable to use a single stage compressor for pressures above 300 psi and even then the performance at altitudes above 20,000 feet is unsatisfactory. A two stage compressor without intercooling has been proved to be satisfactory up to 1000 psi, provided that the normal speed does not exceed 1200 rpm and that adequate cooling air can be provided. A marked improvement in performance is possible by adding a simple inter-stage cooler; such compressors can pump to 1000 psi at speeds up to 2000 rpm. Although the output decreases with increased altitude, the compressor does not stop pumping until a height of more than 40,000 feet is attained. For most purposes, this is satisfactory, bearing in mind that a compressor does not supply air direct to the various services but merely serves to maintain pressure in storage bottles.

In order to increase the output from a given compressor, some aircraft which are fitted with turbine engines are now provided with boosted compressors. Air at pressures up to 50 psi is passed through a precooler to the compressor and the output is thereby greatly increased. The performance of such a compressor under varying conditions is shown in Figure 2. The availability of air from turbine engines at much higher pressures than 50 psi will permit an even higher degree of boosting, with corresponding compressor outputs. Alternatively, the output pressure can be raised since the turbo-compressor can be regarded as the first stage of the high pressure compressor.

Compressor Cooling and Lubrication

It has been found that there is a limit to the size of cylinder which can be employed and that any increase beyond this makes adequate cooling extremely difficult. If lubricating oils of the type used in industrial compressors could be employed, it would be possible to run at quite high temperatures, but as aircraft compressors usually use engine oil, rapid oxidation occurs if temperatures above 320 F (160 C) are exceeded. Furthermore, in the interests of standardization, it is not desirable to use special lubricants in aircraft compressors and as low temperature oils are now a requirement, the compressor designer is confronted with a further problem since low temperature oils generally have poor lubricating qualities and low flash points. Tests on a variety of compressors under different operating conditions have shown that air temperature alone is not the only criterion to be considered in the rate of oxidation of oil. It is now established, within broad limits at least, that both temperature and pressure must be taken into consideration when assess-

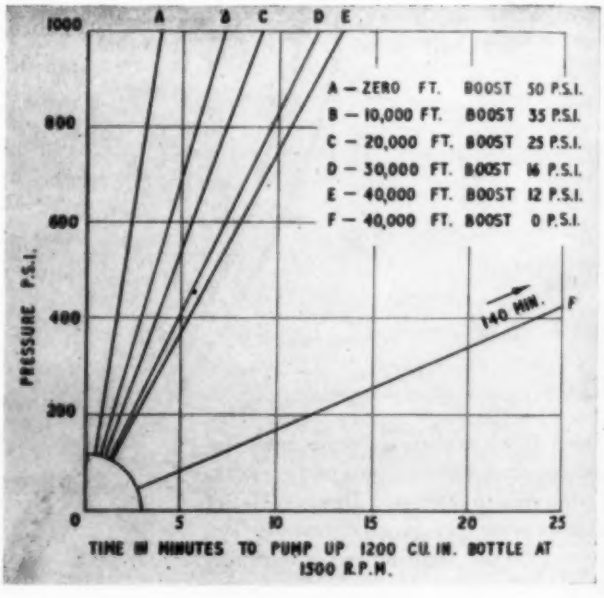

FIG. 2. CHART SHOWS the effect of altitude on compressor output.

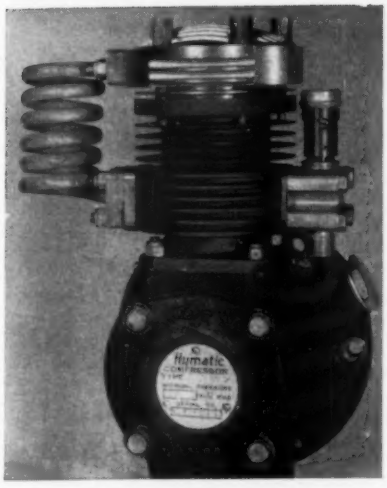

FIG. 3. A CURRENT design of a two-state, stepped piston type aviation compressor. The coil is the inter-cooler. This compressor, weighing only five pounds, delivers 1.9 cfm at ground level pumping at 1000 psi and at 2000 rpm.

ing tendency to oxidation or carbon formation. For this reason, stage ratios are more often determined by consideration of actual air temperatures permissible rather than the more usual practice of doing equal work in each stage.

The cooling compressors during ground running was comparatively simple in piston-engined installations where the slipstream could be utilized; cooling is much more difficult in turbine engine installations. Close attention is required to the design of cowls and ducting and it is fortunate that the heat capacity of the compressor is usually large enough to cope with the temperature rise resulting from the short period of ground running to which turbine engined aircraft are subjected.

In a brief article it is not possible to deal with compressor design in detail. It is of interest to note that the two-stage, stepped piston type as shown in Figure 3, is the result of steady evolution over a period of several years. This compressor has a simple coiled inter-cooler. Weighing only five pounds, it is capable of delivering 1.9 cfm when pumping at 1000 psi and running at 2000 rpm. It is fitted with lightweight plate valves in both stages. This unit develops a volumetric efficiency of 62 percent, sensibly constant over a wide speed range.

Pressure Control

Pressure regulation in British aircraft compressors is usually achieved by means of a valve situated between the compressor and the storage bottle. This allows air to be discharged to atmosphere after storage pressure has been reached, thus in large measure unloading the compressor. Such regulators have a range of about 10 percent of the operating pressure. A typical valve of this type is shown in section in Figure 4, from which it will be seen that pressure acting on the outside

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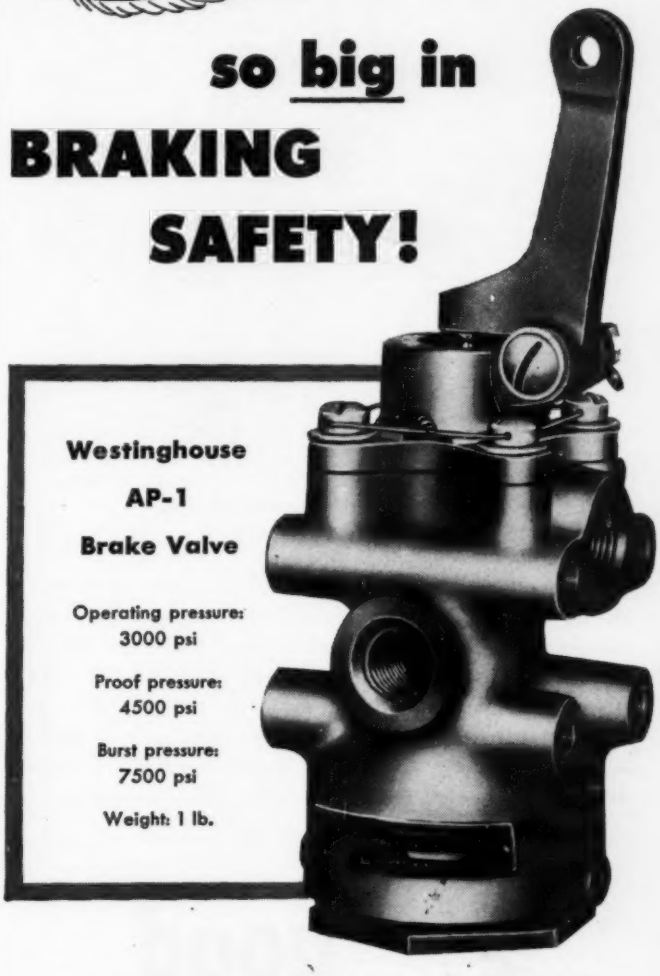

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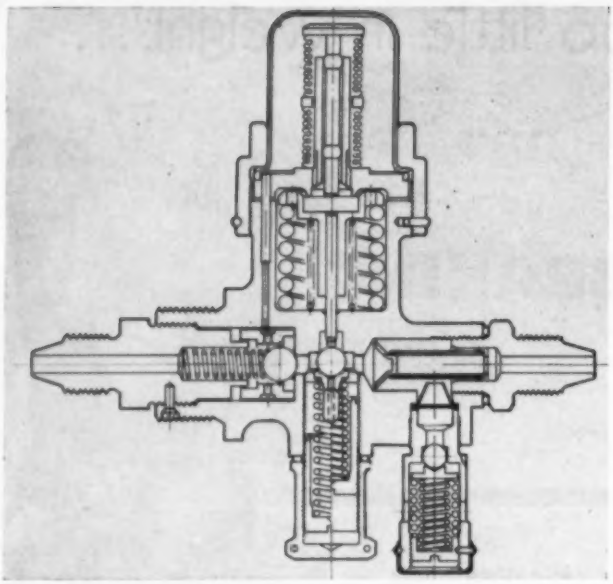


FIG. 4. CROSS SECTION of a typical pressure regulator for unloading aviation compressors.

of the bellows causes a push rod to move against a spring load. When the resistance is overcome due to a rise in pressure, the push rod opens a ball valve which communicates with the atmospheric vent and the compressor discharges against atmospheric pressure. In compressors having more than two stages, it is desirable to incorporate means for unloading the low pressure stages as well as the last, otherwise the degree of unloading is too small.

Attempts have been made to stop aircraft compressors by means of air operated clutches, once the required pressure has been reached. However, such clutches are invariably heavier than alternative unloading means and are less reliable. The pressure switch normally used for controlling pressure in electrically driven compressors is very small and light. This advantage is somewhat offset by the weight of the associated magnetic relay. It is easy, however, to achieve a very small pressure gauge with such switches, coupled with a high standard of reliability.

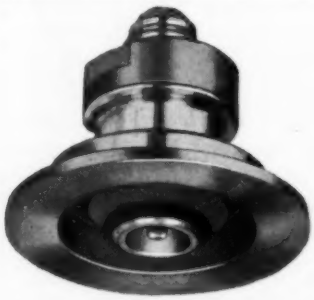
Typical Aircraft Pneumatic Systems

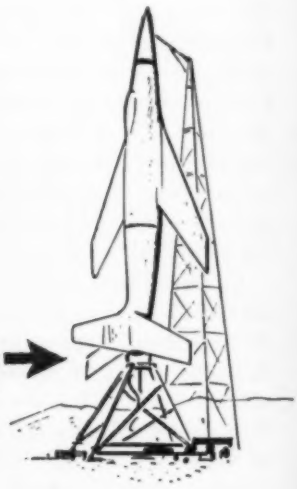
For security reasons, it is not possible to illustrate the latest systems in production aircraft. However, a typical system which is representative of current British practice is shown in Figure 5.

Figure 5 shows a straight-forward system suitable for a small aircraft of the high speed trainer type. It will be seen that there is an orthodox generating system working at 1000 psi, comprising engine driven compressor, oil and water trap pressure regulator and storage bottle.

A pressure maintaining valve is fitted so that the main system is isolated should there be any failure, thus conserving sufficient air for braking purposes. In this particular aircraft, the undercarriage can be released mechanically in emergency and is lowered and locked by gravity. A feature of the system is the electro-

good hunting begins *here*





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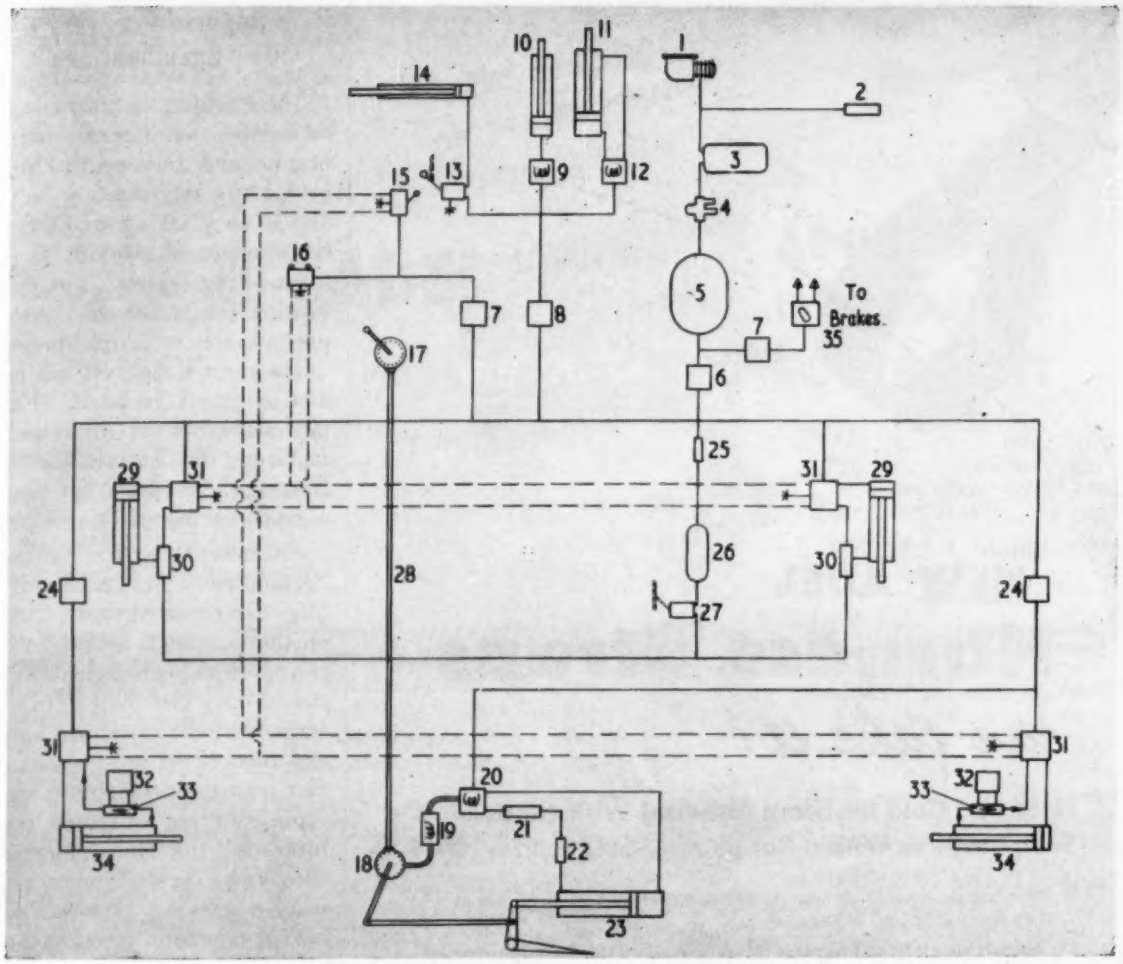


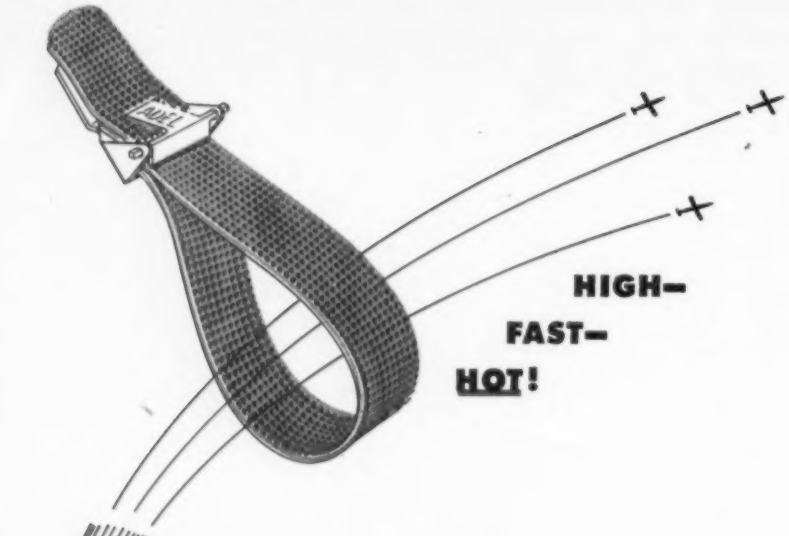
FIG. 5. A pneumatic system for a high speed trainer aircraft.

1. Compressor
2. Ground Charging Valve
3. Oil and Water Trap
4. Automatic Regulator
5. Air Receiver—Normal
6. Pressure Maintaining Valve
7. Reducing Valve—1000/200 psi
8. Reducing Valve—1000/400 psi
9. Electric-Pneumatic Valve
10. Hot Air Ram—Engine
11. Radiator Flap Ram
12. Electro-Pneumatic Valve
13. Amber Screen Control
14. Amber Screen Ram
15. Dive Brake Control
16. U/C Control
17. Flap Control
18. Commutator Switch
19. Relay—Magnetic
20. Electro-Pneumatic Valve
21. Flow Restrictor
22. Relief Valve
23. Flap Ram
24. Reducing Valve—1000/725 psi
25. Non-Return Valve
26. Air Receiver—Emergency
27. U/C Emergency Control
28. Multi-Core Cable
29. U/C Ram
30. Shuttle Valve
31. Relay
32. Reducing Valve—725/100 psi
33. Non-Return Valve
34. Dive Brake Ram
35. Brake Differential Valve

pneumatic follow-up mechanism for the wing flap ram, the function of which will be described in Part 2 of this article. Relay operated valves are placed adjacent to all the main actuators, the operating pressure being 725 psi. In the case of the dive brake rams, which are rather large, considerable saving in high pressure air is effected by the introduction of a reducing valve arranged so that on the retraction stroke, which calls for a very small force output, the air pressure is only 100 psi. The total weight of the system, less tubing, is about 86 pounds; most of the tubing is ¼ inch, the relay system is ⅛ inch.

On a larger system that could be applied to a medium bomber, two motor-driven compressors are used. They feed into a common line to charge normal storage bottles and through a non-return (check) valve to charge the emergency air storage bottles. The capacity of the latter is sufficient to cope with a baulked undercarriage or landing gear when it is assumed that the worst possible sequence of operations likely to be necessary would be to operate the bomb doors once, raise and lower the drive brakes twice and finally to lower the undercarriage. In most emergency operations, it would be necessary to lower the dive brakes only once and then to lower the undercarriage. An emergency bottle capacity which is large enough to cope with a baulked undercarriage is, therefore, more than adequate for most emergency operations.

Part 2 of this article, to be published next month, will discuss individual elements in aircraft pneumatic systems.



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Pneumatic Subcommittee Reports Progress on Specifications

The Pneumatics Subcommittee of SAE A-6 Committee on Aircraft Hydraulic and Pneumatic Equipment held a two day meeting on June 9 and 10 in Washington, D. C., under the chairmanship of A. H. Hobelmann. Progress on a general specification for pneumatic system components and on check, pressure reducer and relief valves was reported and discussed in detail. Thirty five representatives of airframe manufacturers, the Services, the National Bureau of Standards and pneumatic component manufacturers attended.

Pneumatic System Component Specification: M. Caserta of M. C. Mfg. Co. reported to the Committee on the comments which he had received on this proposed spec. These comments, distributed in written form, were discussed and agreement was reached on most points of conflict with the preliminary spec. The representatives of some manufacturers felt that the component spec should be agreed upon and forwarded as soon as possible to the next A-6 general meeting. An effort was made, where practicable, to coordinate the details which were common with hydraulic practice, in particular with AN 5440, General Specification for Hydraulic Systems, which had been approved at the A-6 April meeting. The chairman directed Mr. Caserta to incorporate the changes agreed upon so that the revised spec could be presented at the October A-6 meeting.

Pneumatic Check Valve Specification: Work on this spec was delayed due to the fact that Fred Pollard, Republic Aviation Corporation, of A-6 Committee, was directed to survey the check valve manufacturers after the October meeting last year on the method of rating check valves for performance. Mr. Pollard's survey had asked for certain data on pressure drop plotted against flow from zero flow up to critical flow. The data received was inconclusive and Mr. Pollard, in turn, had asked the Pneumatic Subcommittee to study the problem. He was unable to be present but Dwight Leach, Chance Vought, attended the meeting as one of the two airframe representatives. Ralph E. Middleton,

Lockheed Aircraft, the other airframe representative, also attended.

Dr. M. M. Slawsky, National Bureau of Standards, who is engaged in the BuAer program of fundamental research on pneumatics, outlined a pressure drop determination for a standard ¼ inch check valve which is incorporated in the preliminary BuAer spec for check valves for aircraft pneumatic systems. Dr. Slawsky's data as a standard would qualify all check valves tested by NBS to date.

The chairman asked representatives to test their ¼ inch valves and send this data, a characteristic curve, a plot of downstream pressure divided by upstream pressure times flow divided by upstream pressure to him for quick coordination.

The next meeting of the SAE A-6 Committee is to be held at the Hollywood Roosevelt Hotel, Los Angeles, October 8, 9 and 10, 1952.

Reducer, Pneumatic Pressure Specification: L. A. Carlson, Westinghouse Air Brake Company, reported on the comments he had received from the accessory people. The written comments were distributed and discussed point by point. One of the points of argument was whether the standard reducer valve should or should not incorporate a relief valve (or "overcharge" valve as designated by NBS). After considerable discussion, the term "reducer, pneumatic pressure" was agreed upon rather than pressure control or regulating valve or pressure reducing valve, in part to conform to ASG indexing procedures. No serious differences of opinion were developed and there was general agreement on revisions to the tentative spec. The NBS tentative standard will be coordinated to changes agreed upon.

Relief Valve Specification: Mr. Caserta distributed copies of replies received from manufacturers on the tentative relief valve spec. It was agreed upon, after discussion, to follow a suggestion of S.E. Sanfilippo of BuAer to designate three ranges or types of relief valves: 50-500 psi; 500-1750 psi; and 1750-4000 psi. The agreement was sufficient for the chairman to ask Mr. Caserta to prepare a revision for the next A-6 meeting.

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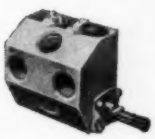

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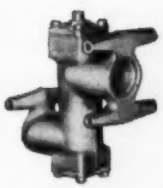

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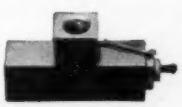

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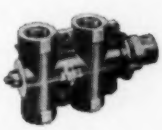

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Powered Flying Controls

Basic control system and the problems of stability are discussed in this first part of a three part article.

Part 1

By F. J. Bradbury and S. M. Parker

This paper was presented to the Institute of Mechanical Engineers, London, during February. Mr. Bradbury and Mr. Parker are on the staff of Automotive Products Ltd. of Leamington Spa, England, manufacturers of aircraft hydraulic equipment and landing gear, and much of the information contained in this paper has been gained in the course of experiments in the Lockheed system of hydraulic power controls for aircraft.

FOR many years the flying-controls of aeroplanes have been operated by manual effort, aided by a considerable degree of aerodynamic balance. The idea of replacing or supplementing this effort by some powered system is not new, but has come into practical use only in very recent years.

There are many applications of what is often called "servo-control", which are much more complex and difficult than the operation of a control surface of an aeroplane. This can broadly be defined as the movement of masses up to some 2,000 lb., through distances of a few inches, as speeds not exceeding 1 ft. per sec., with positional accuracy within 1 per cent. Such requirements should cause little difficulty and demand little original thought from those who are familiar with servo-mechanisms, and this would be true if it were not for the presence of two additional factors.

The first, is the existence of considerable flexibility throughout the system, arising from the nature of an aeroplane as a structure, and the tendency for design to be for a minimum permissible strength rather than for stiffness.

The second is the undisputed need for exceptional reliability in a service so vital to the safety of the aeroplane and its occupants.

There is no generally accepted method of grouping servo-mechanisms, therefore the one chosen in this instance is arbitrary and devised to suit flying controls in particular.

The first division to be made is between (1) free systems, and (2) mechanically coupled systems, and is illustrated in Fig. 1.

FREE SYSTEM. In Figure 1, A is a lever of negligible mass which can be moved by human effort at very high speed. It is coupled to lever B by an undefined, but not entirely mechanical, means, containing a signalling and power system. Lever B is required to operate a considerable mass against a considerable load, and its speed of movement is limited by the ratio of net force available to mass. Thus, if lever A is moved rapidly there will be a momentary or transient error in the true position or phase relation which the mechanism is intended to maintain. This has been termed the "free system", because there is negligible restraint on the movement of lever A.

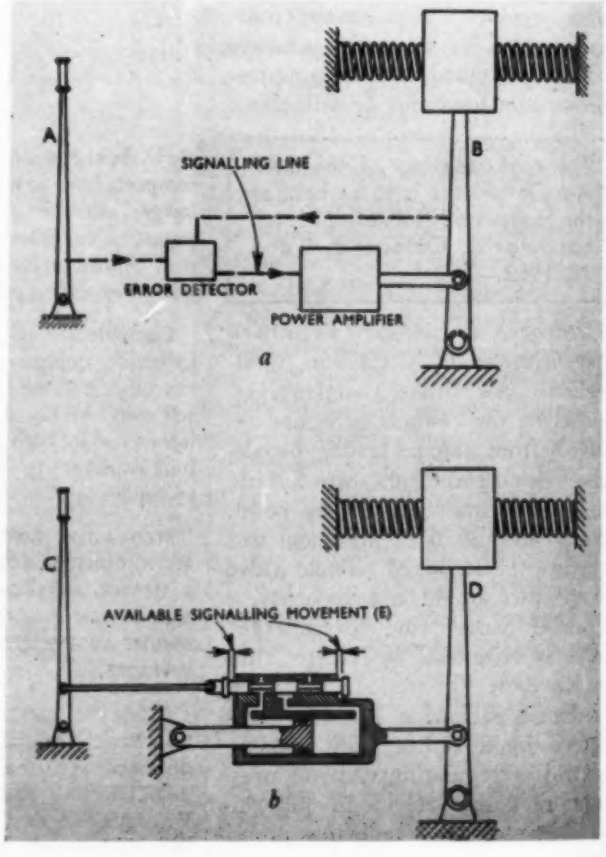

Fig. 1. Servo-mechanisms
a Free system. *b* Mechanically coupled system.

MECHANICALLY COUPLED SYSTEM. In the mechanically coupled system lever C is connected to lever D, and a small amount of free movement only is provided at E to actuate the signalling and power system. Lever D operates under the same conditions as lever

B, and thus has the same speed limitations, which apply also to lever C. In this system the transient error is very small and is limited to the free movement provided to operate the signalling system.

While either system can be used to operate the control surfaces of aeroplanes, the mechanically coupled system has been most widely adopted. This is due to a desire to avoid a major change in the flying technique of the pilot, and because such a system can provide limited manual control in the event of power failure, which is useful in some aeroplanes.

The next division to be made lies in differences in the types of signalling means. Clearly, such signals must be derived from the existence of some error in the true phase relation between levers A and B or levers C and D, but the nature of the correction can depend on:

(1) existence of error;
(2) sign of error, that is, whether positive or negative;
(3) extent of error; and
(4) rate at which error is developing.

The simplest system must use the first two, but the second two are progressive refinements. This leads to the possibility of three different systems.

"ON-OFF" SYSTEM. The simplest system is conveniently termed the "on-off" system, in which correction by the maximum available force, and in the right sense, is applied until the error disappears or, more truly, is reduced to a predetermined and acceptable minimum. At this instant the system is moving at maximum speed and, if it contains appreciable mass, cannot be brought to rest instantly and will therefore overshoot. The extent of overshooting will depend on the natural losses in the system, and will probably be sufficient to bring about power correction in the opposite direction. If the system can detect small errors this process can continue indefinitely, either in a controlled way, which is normally termed "hunting", or in a more rapid way which is usually referred to as "instability". The existance of considerable flexibility in the system will greatly increase the difficulties.

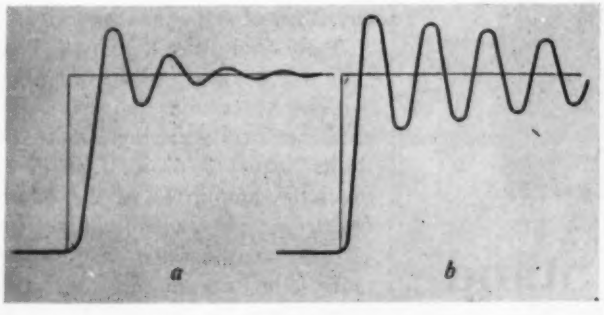

Fig. 2. Servo-mechanism Characteristics
a High stability. *b* Low stability.

Such a system can be used, therefore, only when mass and speed of operation are low, and when the error to which the system is responsive can be large.

A close approximation of this system has been used in some hydraulic installations, when the limitations outlined have been much in evidence.

PROPORTIONAL SYSTEM. The second system adds to the mechanism of the "on-off" arrangement,

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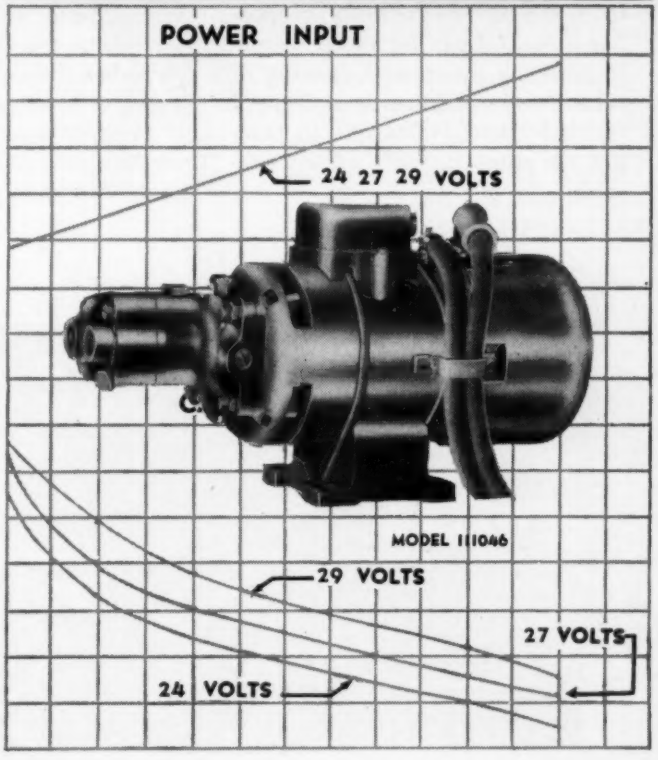

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. . . electric motor driven

- High pressure—3000 p.s.i.
- High capacity—.4 g.p.m. at 3000 p.s.i.
- High volumetric efficiency—96% at 2500 r.p.m., 3000 p.s.i.
- High torque efficiency—90% at 2500 r.p.m., 3000 p.s.i.
- Low weight—14 lbs.
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The model of pump illustrated above is equipped with a continuous duty, open ventilated motor. Other models are available with totally enclosed, explosion-resistant motors for hazardous locations.

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means whereby the correction is more or less proportional to the degree of error. The advantage of this is particularly obvious in a free system, where the error can be large, but the improvement is also necessary in the mechanically coupled system to increase stability. In hydraulic mechanisms proportional control can be added merely by ensuring progressive opening of valves, and no increase in complication is thereby involved. In practice, the proportionality will not necessarily be linear.

DERIVATIVE SYSTEM. It is also possible to add to the proportional system a mechanism which responds to the rate of change of error. Thus, if the error is not only large but also increasing, the correction is also increased. This arrangement can be termed the "derivative" system, and shows to advantage when large transient errors can exist and when their duration must be reduced as much as possible.

The mechanism of this system is inevitably more complex than either of the two previously described and, as the stability is but little improved, there is no object in applying such an arrangement to the mechanically coupled system.

It seems therefore logical to find the proportional system in general use in preference to either of the two possible alternatives.

Stability

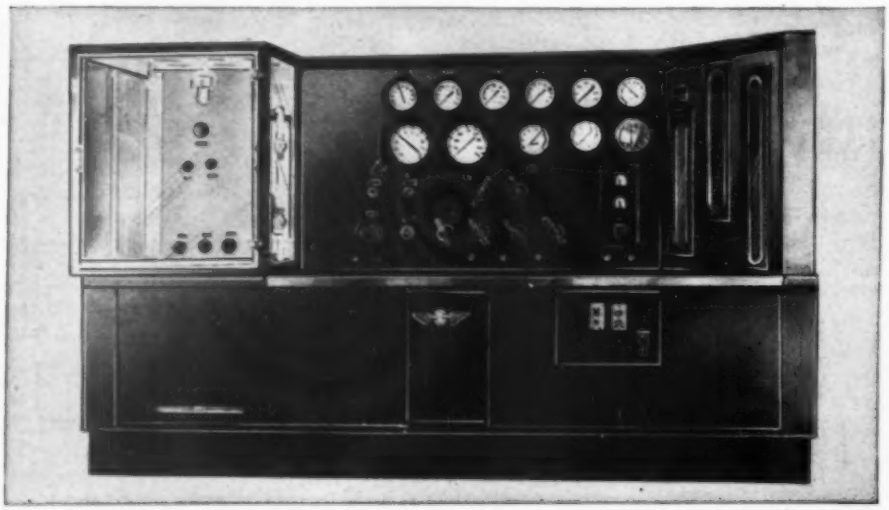
In text-books on servo-mechanisms "stability" is used to describe the way in which a system returns to a steady state of equilibrium after disturbance. Its meaning is somewhat similar to that of the term "damping" in electrical systems, Fig. 2a shows the characteristics of a system having a high degree of stability, and Fig. 2b those of one having a low degree of stability. So far this characteristic has not been given much attention in flying-control systems, and the term "stability" has been used in an entirely different connection, namely, the degree to which the system is free from any form of self-excitation.

At this point the existence of considerable flexibilty in the system becomes of extreme importance for, as the natural damping is low, flexibility leads to oscillations of appreciable amplitude at the natural frequency of the individual parts of the complete system. Furthermore, the presence of a power source acts as an amplifier, and still greater amplitude of movement can be built up. These movements must not be allowed to influence the faithful transmission of movement from the input to the output end of the system.

Practical installations must provide some means of filtering out these unwanted movements, and the factors which give rise to them must be kept within reasonable control.

Paradoxically, therefore, the success of a powered flying-control lies not in its ability to reproduce faithfully all movements, but in the achievement of adequate insensitivity to many types of input signal, especially those of an oscillatory nature.

The means of securing this almost human degree of discrimination gives to the designer his main problems, and some analysis of these difficulties and the means of overcoming them will be outlined in part two of this article in the September issue of APPLIED HYDRAULICS.



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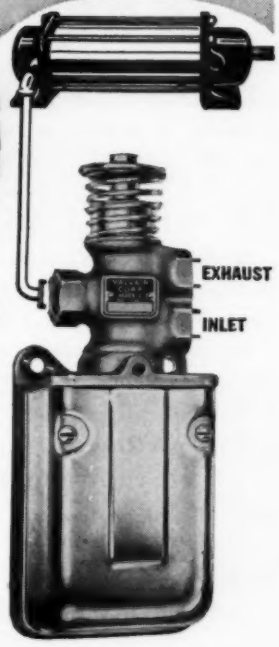

. . . and its dependability is due to many quality features. *Examples:* the "O-U" packer, no metal seats, heavy solenoid and standard pipe area through valve, permitting unrestricted air flow. Yet Valvairs cost no more.

For use with air, water or oil pressures up to 175 p. s. i.; temperatures up to 140° F. 2-way, 3-way, 4-way. Also in knob, lever, cam, clevis, foot, treadle, cylinder, diaphragm types.

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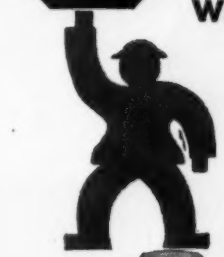

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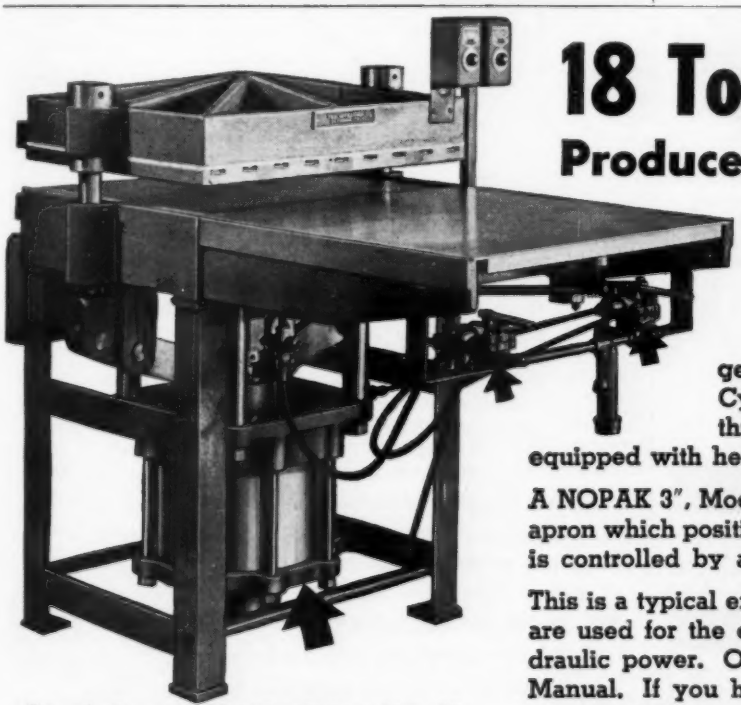

Ostrander-Seymour Pre-heat Gap Press used in molding All-Plastic Printing Plates. Arrows indicate position of 14", Model "C" NOPAK Cylinder and 2 NOPAK 4-Way Valves. (The 3" NOPAK Cylinder is not visible).

•

Refer to Sweet's File for Product Designers, or write for Bulletin SW-1.

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18 Ton Platen Pressure Produced by NOPAK Cylinder

This Pre-heat Gap Press is designed and constructed expressly for the efficient molding of All-Plastic Printing Plates . . . by the Ostrander-Seymour Company of Chicago. 18 Ton Platen Pressure is generated by a 14" NOPAK Model "C" Air Cylinder, working at 100 P.S.I. line pressure, through toggle leverage. The upper platen, equipped with heating coils, is pulled down onto the work.

A NOPAK 3", Model "E" Cylinder operates the sliding, loading apron which positions the work under the platen. Each cylinder is controlled by a NOPAK ⅜", 4-Way Hand-Operated Valve.

This is a typical example of how NOPAK Valves and Cylinders are used for the efficient application and control of air or hydraulic power. Others are shown in the NOPAK Application Manual. If you haven't seen it, write or ask your NOPAK representative.

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DESIGNED for AIR and HYDRAULIC SERVICE

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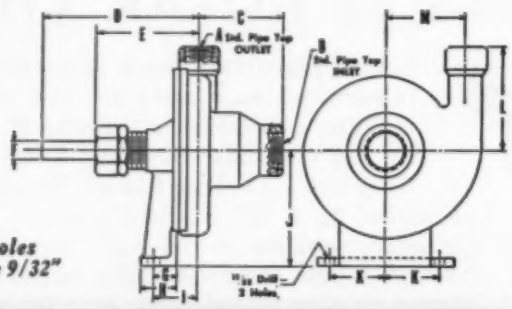
Standard OBERDORFER Series G BRONZE CENTRIFUGAL PUMPS

Centrifugal pumps must be primed or located below the level of the liquid to be pumped so that they will be gravity fed.

These pumps may be driven with a V belt pulley or directly connected to an electric motor by a flexible coupling. They are used for pumping fuel oil, gasoline, water, coolants, brines and many other liquids. The open impeller design permits the handling of a percentage of semi solids.

The 4G and 9G may be operated with a ¼ horsepower motor. The efficiency of a centrifugal design is increased greatly by increasing the r.p.m. of the shaft. The 1G requires but a 1/12 horsepower motor when operating at 3450 r.p.m.



**Foot holes in base 9/32"*

DIMENSION TABLE

No.	A	B	C	D	E	F	G	H	I	J	K	L	M
1G*	⅛	¼	2 3/32	3 1/16	2 3/32	5/16	5/16	⅝	1/64	1 13/16	1⅝	2 3/32	1⅛
4G	½	¾	2 9/16	4 1/16	2 11/16	½	½	1	1¼	3¼	1½	3	2 5/32
9G	1	1¼	2 15/16	5 9/16	3 5/16	½	1 1/16	1 3/16	1½	3¼	1½	3⅝	3 5/32

CAPACITY TABLES

Pump No.	Speed	H.P.	Inlet	Outlet	Gallons Per Minute—Head in Feet							
					0	4	6	8	12	16	20	24
1G	1725	1/12	¼	½	2.00	1.05	0.10	—	—	—	—	—
1G	3450	1/12	¼	½	4.00	3.70	3.50	3.25	2.75	2.10	1.25	0.10
4G	1725	¼	⅜	½	10.75	7.50	4.00	—	—	—	—	—
4G	3450	¼	⅜	½	23.00	22.00	21.58	21.00	18.75	15.25	11.50	8.00
9G	1725	¼	1¼	1	35.00	32.66	31.66	29.50	26.00	21.66	15.00	3.50

PRICE LIST

No. 1G $9.25	No. 4G $16.00	No. 9G $24.00

Industrial Pump Div., Oberdorfer Foundries, Inc.
528 Thompson Rd., Syracuse, N. Y.

Reducing Noise In Steering Systems

Concluded from page 49

noise reduction by minimizing the entrapment of oil creation of a vacuum in the sealed volume between the rotors and the sealing land between the ports.

Use of Pulse Filters

With all these charges the pump noise was still objectionable. Concurrently, with the development of the pump various type hydraulic pulse filters were tested.

Some general observations were made concerning the performance of these filters as regards location.

1. Pulse filters "Teed" into the oil lines were relatively ineffective.

2. To be effective the pulse filters had to be in series with the flow.

3. Pulse filters were relatively ineffective in the return line as compared with the pressure line.

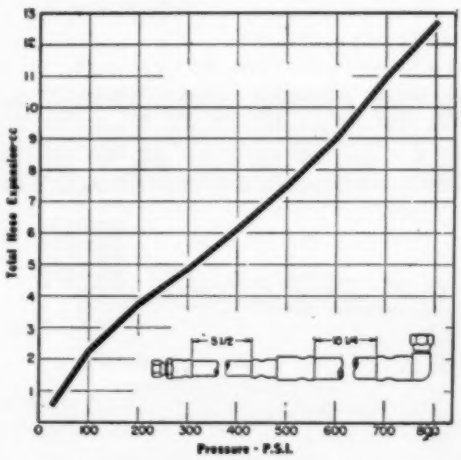


FIG. 3 PULSE FILTERS in series with flow are effective in the reduction of noise. A 10¼ in. length of highly expansible ⅜ in ID hose is in series with 5½ in. length of ¼ in. ID hose. The curve shows the desired volumetric expansibility of the hose.

4. Air cushion chambers in direct contact with the oil were most effective in reducing the pulse amplitude, but were impractical because of the time lag and loss of power when the air was being compressed, and because of the absorption of the air by the oil.

5. Many satisfactory pulse eliminators, some of which resembled a bag pipe, were developed.

6. The best and the one selected for production consisted of a section of three-eighths inch inside diameter specially designed highly expansible hose in series with a section of conventional one-fourth inch inside diameter hose. Desired volumetric expansibility of this hose is indicated by curve on Figure 3.

Adapted from a paper presented by Mr. Hunter at the seventh National Conference on Industrial Hydraulics, November, 1951.

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Design: The over-all construction is rugged for long, trouble-free operation. Indexing is smooth and easy yet positive and shock proof. The operating mechanism is convertible for maintained or spring return action. Screw type terminals are provided and terminal blocks with contact fingers are easily replaceable.

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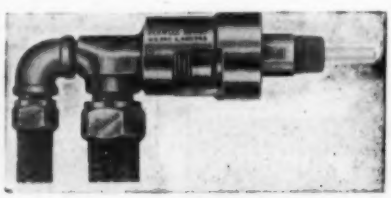
Long Island City, New York

Rating: 150 psi, 350 rpm, 350 degrees F. standard size from ½ in. to 1¼ in. IPS, larger sizes in preparation.



Features: External screw adjustment by means of which normal wear of rotary seal can be compensated for on the spot, in service, without removal of rotary joint, thus preventing leakage and greatly reducing maintenance costs. Floating rotary seal, made of special graphite composition, is self-aligning in any direction, axially as well as radially, thus eliminating leakage so often caused by misalignment of rotary shaft. Pressure equalizing chamber relieves rotary seal of excessive pressure, reduces friction, wear and power consumption.

Application: Designed to convey liquids and gases from a stationary pipe line to a revolving receptacle.

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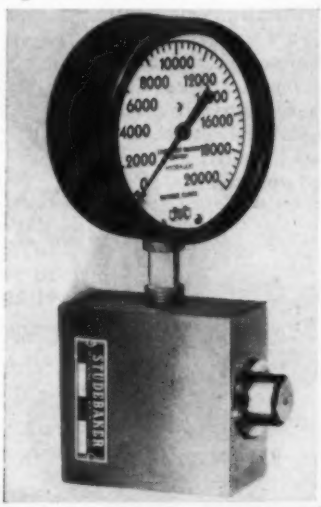
Pressure Tester

Studebaker Machine Co.,
Maywood, Illinois

Sizes: Made in three sizes, 0 to 10,000 lbs.; 0 to 50,000 lbs. and 0 to 100,000 lbs. Special pressures over 100,000 lbs. available on special order.



Construction: Self contained hydraulic unit, accurately calibrated. Heavy duty, rugged construction for long life. Simple design.

Application: Directly and accu-

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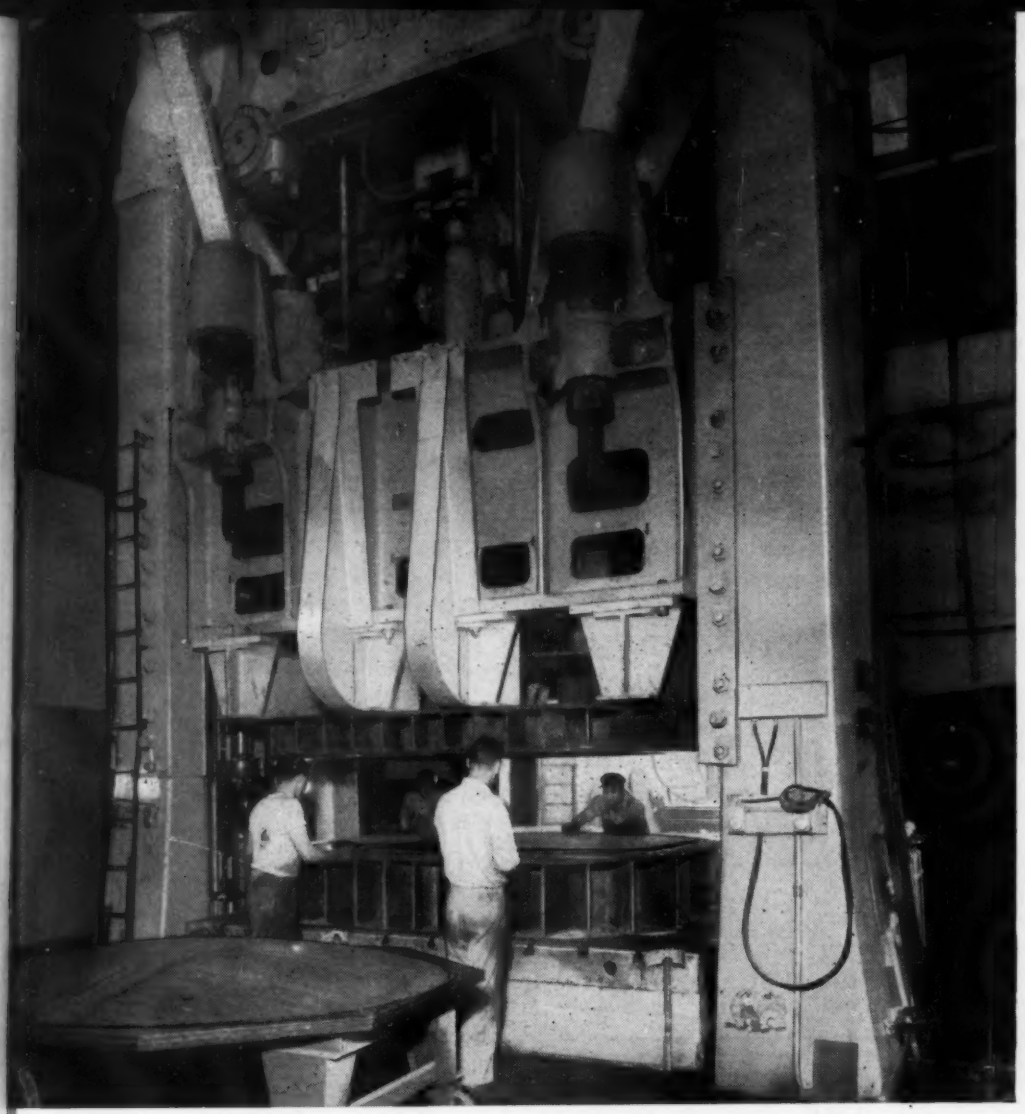

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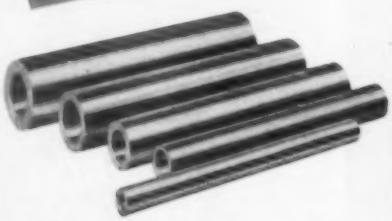

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Tougher, harder and stronger, it resists shock loads and withstands high compressive forces and will not cut or stick to the shaft under ordinary operating conditions. There is no seizing, no scoring—just smooth, quiet operation. Will not powder under the most severe conditions of service. When lubrication fails temporarily, Promet carries on safely until proper lubrication can be restored, affording protection against production shutdowns.

PROMET FULLY MACHINED BARS SAVE YOU TIME, TOOLS AND MONEY!

Completely precision machined inside, outside and on the ends, yet sufficient stock remains for the finishing cut. Can be machined at speeds of more than 500 feet per minute—more than double those of phosphor bronzes. This complete machining insures you against subsurface defects sometimes found in rough cast bars. A considerable amount of metal has already been removed—metal which you would be purchasing if you used rough bars. Every bar is absolutely concentric.
Available round, hexagon and square, in 13-inch lengths, rough cast.

MONEY-BACK GUARANTEE

of longer, superior service and lower maintenance cost.

FREE ADVISORY SERVICE

Our competent design and engineering staff will be glad to assist you in solving your special bearing problems.

Send today for free literature

THE AMERICAN CRUCIBLE PRODUCTS COMPANY

1303 Oberlin Avenue Lorain, Ohio
Please send free literature on Promet Cored and Solid Bronze Bar Stock.

Name .....
Firm .....
Street .....
City & State .....

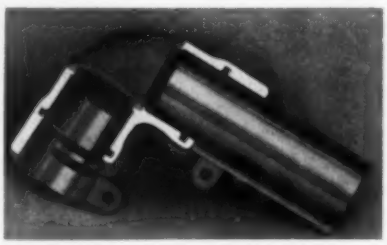
rately indicates the actual force in pounds exerted by press ram. It has broad application for determining weights and total pounds force on all types of presses. It is most valuable in insuring quality control against inaccurate ram force. Used either vertically or horizontally.

Circle 157 on Reader Service Card

Stainless Steel Coupling

Pete A. Frasse and Company, Inc.
New York, N. Y.

Designation: Quikupl stainless steel fitting.



Features: Chief advantage for the new fitting is that it can be joined to tube or pipe without threading, flaring, sweat-soldering, brazing or welding, saving the cost of these operations. With the Quikupl fitting, pipe or tube is simply cut to length, deburred and inserted in the fitting. The coupling is completed merely by tightening a small screw.

Design: The new stainless steel fittings resemble standard elbows, tees, ells and other universal shapes, with the tradition of a clamp which is an integral part of the fitting. Inside the fitting is a synthetic sealing ring which is contained in a groove machined into the bore. This resilient seal is so constructed that it will provide and maintain a squeeze fit regardless of commercial tube and pipe tolerances.

Circle 158 on Reader Service Card

Air Powered Work Feeder

The Bellows Company
Akron, Ohio

Designation: Transfeed Work Feeder.

Design: Consists of a movable, mild steel table top, 11/16 in.

I've been making DURAMETALLIC Packings for over 20 Years!

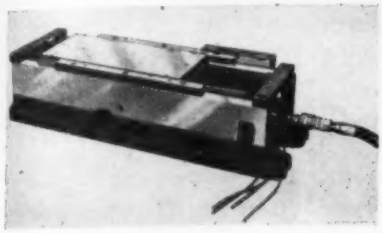
DAN SMITH
23 years' experience in producing Durametallic Packings.

It pays to specify packing that has been produced by *packing specialists.* A score of men, like Dan, have been with the Durametallic Corporation for periods of 10 - 20 and 25 years. Convincing evidence why Durametallic Flexible Metallic Packings are performing the most dependable sealing jobs in industry.

The PERFECT SEAL

DURAMETALLIC CORPORATION
KALAMAZOO MICHIGAN

thick by 5¼ in. wide by 12 in. long, which is guided between hardened and ground dovetail ways. Power for the transverse



motion of the table top is supplied by a special Bellows BEM 5-60 air motor with a built-in Electroaire valve.

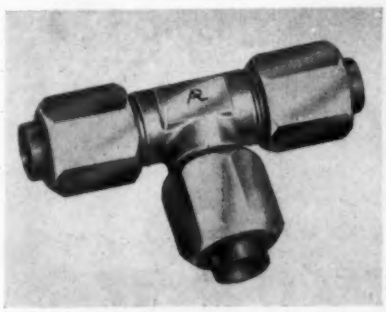
Application: Has a 6 in. transverse positioning stroke which allows the operator to load and unload work at one end of the table while the machining operation is taking place at the other end—thus doubling machine tool production. Fixtures for holding the work may be mounted directly to the table top or to oversize table tops. The unit is equipped with adjustable positive stops, for accurate work positioning, that eliminate manual error and resulting spoilage loss.

Circle 159 on Reader Service Card

Aluminum Tube Fittings

The Parker Appliance Company, Cleveland, Ohio

Sizes and Styles: The line includes male and female connectors, elbows, tees, union and tube end reducer for ¼, 5/16, ⅜, and ½ in. outside tubing. This new line of aluminum fittings is provided in the Parker Triple-lok design.



Application: Aluminum is highly resistant to corrosion and reaction with the fluids handled; tube in such alloys as B5OS is

Visit **BOOTH 119** National Electronics Conference • Chicago • September 29-31

ACCURATELY MEASURES

Rate of Acceleration or Motion

up to 20,000 per second *without* contact

other uses
Measure acceleration and velocity. Trigger or synchronize cathode ray oscillograph sweep circuit angular position indicator (shaft or fly-wheel), reference marker (degrees, position or dead center). Indicate RPM, operations, cycles or motion at rates in excess of 20,000 per second when used with electronic counters.

Model 3010 U.S. Pat. 2396703

NEW Electro ELECTRONIC EQUIPMENT **IMPULSE GENERATOR**

Small low cost electromagnetic pick-up amplifies electrical impulses for counting recurring operations, revolutions, sequences, cycles or motions. It produces a voltage output proportional to the object's rate of speed. And may be actuated by the displacement or vibration of any magnetic material in the field of the pick-up. Such as a slot or keyway in the rim of a wheel or shaft, the teeth in a gear, or any magnetic part on a moving body.

Consult Our Engineers On Your Particular Problem. Write for Bulletin MP 552 Today!

ELECTRO PRODUCTS LABORATORIES

4501-Hu North Ravenswood, Chicago 40, Ill. In Canada: ATLAS RADIO CORP., LTD., Toronto

STAMP OF APPROVAL

KOBE **Heavy Duty High Pressure**

Triplex Pumps

Case History A9: **California Rubber Products, Inc.,** Hawthorne, California manufactures molded and extruded rubber products. Since September, 1946, the Company has used two Size-2 Kobe Triplexes to operate presses. The service is intermittent, 24 hours a day, 5 days a week, at 1900 p. s. i.

Trouble Free Performance

California's shop superintendent, C. L. Arends, reports trouble-free service from the Kobe units. His enthusiasm is reflected in this statement, "We have only had to shut down once in the almost six years since the Kobe Pumps were installed."

If your problem is hydraulic "power in a package", the package to buy is Kobe.

Triplex Features

- Pressures—To 5,000 psi (standard) To 20,000 psi (special)
- Volumes—To 60 g.p.m.
- Power Ratings—15, 30, and 50 H.P.
- Integral Double Reduction Gears
- Integral Electric Drive (Optional)
- Easily interchanged Plungers and Liners

Write for Bulletin

KOBE INC., Division of Dresser Equipment Co., 615 NBC Bldg., 815 Superior Ave., N.E. Cleveland 14, Ohio

KOBE INC.
Division of Dresser Equipment Co.
Plant: Huntington Park, Calif. — Representatives in CLEVELAND, Pittsburgh, New York, Houston, Oklahoma City.

Type VEU-GH Upright

U.S. VARIDRIVE

DEVELOPS *EXTRA* MACHINE OUTPUT YOU NEVER DREAMED POSSIBLE

Automobiles go modern with automatic transmissions. Production machines go modern with U. S. Varidrive—*the miracle motor.* It changes to any selected speed *instantly.* The Varidrive can run in unison with the rhythm of the operator. It will increase your workers' abilities and quality of product. It can be run slow or fast or at any in-between speed, right to a split rpm. Machines that "loaf on the job" can be stepped up to unlock their surplus capacity. You don't have to change gears, shift belts or use a rheostat. Just turn a control dial. The U. S. Varidrive Motor is self-contained, all on one base, embodying a motor with a built-in speed control. By increasing machine output, the Varidrive repays its cost within a few weeks or months. *Install Varidrives* for greater profit.

Type VE Horizontal Varidrive

YOU GET THESE *Extra* ADVANTAGES

- MORE OUTPUT EVERY HOUR
- LESS LABOR COST PER UNIT
- ELIMINATE GEAR BOXES
- COMPACT, ENCLOSED, STREAMLINED
- DIRECT CONNECTION TO MACHINE
- 10 TO 1 SPEED RATIOS
- SHOCKLESS TRANSMISSION
- SMOOTH, QUIET OPERATION
- SIMPLEST DIAL CONTROL
- WEATHERPROOF HOUSING

U. S. VARIDRIVE MOTOR

2 to 10,000 RPM

U.S. ELECTRICAL MOTORS Inc.
(Box 2058) Los Angeles 54, Calif., or Milford, Conn.

Get This Profit-Revealing Bulletin

Describes U.S. Varidrives, with interesting color illustrations of various types and sizes from ¼ to 50 h.p. Tells how you can cut production costs.

REQUEST FOR U. S. VARIDRIVE MOTORS BULLETIN

U. S. Electrical Motors Inc. AH-8
(Box 2058) Los Angeles 54, Calif., or Milford, Conn.

Name _____

Company _____

Address _____

City _____ Zone _____ State _____

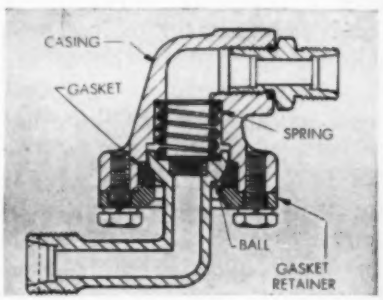
readily available in long lengths, and has good workability characteristics for easy flaring and bending. System weight is held to a minimum, and total cost is substantially less than for a copper-brass system.

Circle 160 on Reader Service Card

Hydraulic Swivel Joints

Barco Manufacturing Company
Chicago, Illinois

Sizes: Produced in four different styles with straight or angle connections for use with ¼, ⅜, ½ or 5/8 in. tubing or equivalent size pipe. All styles and sizes are offered with a choice of



thread connections: AN, Industrial Ermeto, or standard pipe threads. Pressure ratings are 3000 psi hydraulic with steel or aluminum casing and stainless steel ball. Depending on service temperatures ranging from –100 degrees to +500 degrees F. can be accommodated.

Feature: The joints are self-aligning, which greatly simplifies and speeds up installation when working with tubing or pipe where it is difficult to attain perfect alignment. The self aligning feature is also of prime importance in service as a result of eliminating binding and minimizing wear.

Circle 161 on Reader Service Card

Air Filters

C. A. Norgren Co., Englewood
Denver, Colorado

Size: For ¾" and 1" Air Line
Construction: The transparent plastic bowl holds 1 pint below the baffle. Drained by opening the drain cock. The bowl is easily removed for cleaning and replacement, it is fully automatic and requires no adjustment. One of the important features of this new filter is the special baffle which traps the moisture and

Circle 50 on Reader Service Card

Specify the MONARCH Hydraulic Pressure PUMP for NEW and existing equipment - -

The type TUH (Illustrated)
Features oil reservoir case (with foot mounting bracket), 3 way valve control for single-acting rams, and necessary piping. A completely self-contained control.

Other features of the HY-LO-JACK UNIT
- 1,000 Lbs. per sq. inch pressure.
- Only one (replaceable) internal pump unit.
- Less than one horsepower to operate.
- Mounts on most types of equipment with minimum of time and tools.

Write NOW for complete details to—

MONARCH ROAD MACHINERY CO.
Hydraulic Division 327-29 FRONT AVE., N. W. GRAND RAPIDS, MICHIGAN

UNBRAKO
DRY-SEAL THREAD
PRESSURE PLUGS

SEAL TIGHT
without compound
. . . provide positive sealing even under extreme pressures

UNBRAKO *Dry-Seal* Pressure Plugs—in a full range of sizes from 1/16" to 1¼" National Pipe Thread "Fuel"—are available from your local UNBRAKO distributors' stock. For descriptive literature, write STANDARD PRESSED STEEL CO., Jenkintown 2, Pennsylvania.

UNBRAKO SOCKET SCREW DIVISION
SPS
JENKINTOWN PENNSYLVANIA

Circle 73 on Reader Service Card

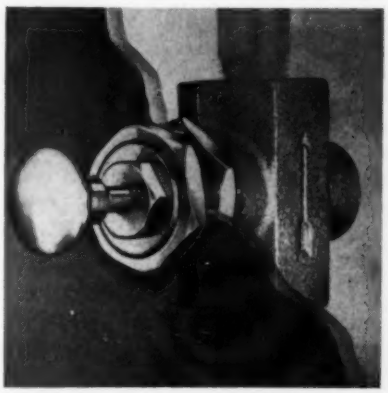
solids in the bottom of the bowl where they cannot be drawn back into the air line. Three types of filter elements are available, reinforced 200 mesh (74 microns) monel metal screen is standard. 25 and 64 micron sintered metal filter elements can be furnished.

Circle 162 on Reader Service Card

Self-Closing Push Valve

King Engineering Corp.
Ann Arbor, Michigan

Styles: Model PV for mounting on panels of any thickness up to



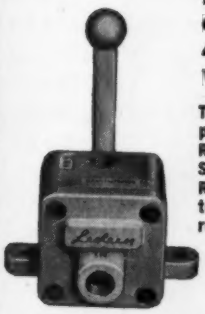
7/16 in. and model LV for in-the-line mounting. Inlet and outlet are tapped for ¼ in. pipe, and direction of flow is shown by an arrow.

Operation: The valve is opened by pressing a knob on the valve stem and closes automatically when the knob is released. It has no compression packing and requires no adjustment, being sealed by neoprene O-rings. The O-rings are readily accessible by removing a nut and lifting out a valve stem. On breakdown test, the valve shows no leakage after 1,000,000 cycles of operation. Discharge rate is 25 to 30 cubic feet per minute at a pressure drop of 100 psi.

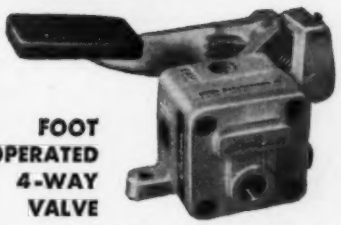
Application: For use in air lines where manual control of an intermittent flow is required and where there must be no leakage through the valve or around the valve stem. Typical applications include use with hydrostatic gages and other instruments requiring a manually controlled blast of air and use with single and multipressure test stands.

Circle 163 on Reader Service Card

Your Cylinder's Good Friend...
Ledeen VALVES



HAND OPERATED 4-WAY VALVE
Three models: Completely Manual—Spring Return to Neutral—Spring Return to Reverse. Flow cycles to handle most requirements.



FOOT OPERATED 4-WAY VALVE
Same as Hand Operated Valve, except foot operation replaces hand. Leaves hands free for other work.

POWER OPERATED 4-WAY VALVE
For remote control, safety or automatic equipment. Suitable for solenoid, cam, finger, toe or hand operation.
Ledeen valves are built in sizes from 1/8" to 1¼" standard pipe tap—to operate air and hydraulic cylinders and motors, single and double acting.
Write for Bulletin 1000

VALVES • CYLINDERS
AIR-HYDRAULIC PUMPS & BOOSTERS
VALVE ACTUATORS • AIR HOISTS
Ledeen Mfg. Co.
1610 So. San Pedro
Los Angeles 15, Calif.

Circle 41 on Reader Service Card

APPLIED HYDRAULICS

Post Scripts of Industry

News about people, manufacturers and sales organizations

Herm Boley was been appointed to the position of assistant to the president of the **Denison Engineering Company.** In 1923 he became general manager of the Johns Manville Boley Ltd., a subsidiary of the Johns Manville Company, located in Buenos Aires where he remained until 1947. He then joined the E.C.A. later known as the M.S.A. and until recently was connected with the U.S. Embassy in London.

Herm Boley

Robert T. Jones, formerly sales engineer in New York and adjoining areas, has been appointed field engineer by the **Chiksan Company** with headquarters at the company's main plant in Brea, California.

John F. Powers, Jr. has joined the Newark sales office of **Chiksan Company.** Mr. Powers has previously been associated with Manne-Knowlton Insulation Company and H. O. Canfield Co.

New branch office industrial managers have been named for the Industrial Division of **Minneapolis-Honeywell Regulator Company.** Robert M. Woodside was appointed branch industrial manager at Cleveland, **John O. Paull** in Los Angeles and **Lee Aplin** in San Francisco.

J. E. Rhoads & Sons has appointed three new sales engineers. **Charles B. Blanchard** will replace W. A. Garrison in the New York State territory, making his headquarters in Syracuse, N. Y. **Donald C. McClure** will cover the states of Illinois and Missouri, **Warren A. Johnson** covering Iowa and sections of Minnesota, South Dakota and Kansas. Both men will operate out of the Chicago Branch office.

Hydraulic Power & Equipment Company, Portland, Oregon, has been named distributor for O-ring seals manufactured by the Parker Appliance Company, Cleveland.

Control Engineering Corporation of Canton, Mass., has appointed **Peacock Brothers Ltd.** as exclusive distributor in Canada for their line of pressure measuring devices.

Robert S. Swain of **Pantex Manufacturing Corporation,** Pawtucket, has announced the completion of arrangements for products of their Hydraulic Division to be marketed throughout the Dominion of Canada by the **Prenco Progress and Engineering Corp., Ltd.** J. K. Chmel, managing director with headquarters in Toronto will be in charge. J. R. Robbins Company, Atlanta, will be representative throughout the southern United States, L. A. Thompson resident manager.

J. E. Lonergan Co., Philadelphia, have reorganized their sales management. Eastern and western sales divisions have been set up and defined by a line extending from Detroit to New Orleans. **A. F. Stumm** will be in charge of the eastern division while **W. F. Braun** will manage the western territory. R. V. Smith has been appointed works manager.

Columbiana Engineering Company, Columbiana, Ohio has been appointed American distributor of Airhydropumps, manufactured by Charles S. Madan & Co. Ltd. in England.

The Cushman Chuck Company of Hartford appointed **John E. Hathaway** as representative in the Ohio territory with headquarters in Cleveland. Mr. Hathaway succeeds William C. Gaw who was recently appointed sales manager of the company. Prior to his affiliation with Cushman, Mr. Hathaway was an industrial engineer in the machine shop section of the Euclid Road Machinery Company.

Roy Carter has been appointed manager of the Volute Pump Section of **Worthington Corpo-**

ration. L. H. Garner has been appointed manager of the Process Pump Section and **I. J. Karassik** has been appointed manager of the Multi-Stage Pump Section. All three men were formerly assistant to the manager of the Centrifugal Pump Division.

Don Preston has been appointed chief engineer of **E. B. Wiggins Oil Tool Company, Inc.** Los Angeles.

Hydraulic Systems Inc., a subsidiary of **Lytle Engineering Co.,** Cleveland, has been appointed Ohio distributors for Superior Hydraulic Division, Superior Pipe Specialties Co. A. C. Jenny, recently named vice president, will be in charge of sales. Jenny was with the commercial engineering division of Jack & Heintz for 11 years.

H. W. Bluethe, has joined the **Lindberg Engineering Company,** Chicago, as sales promotion manager. He will be in charge of publicity, public relations and sales analysis.

New officers elected at the annual meeting of the **American Society of Lubrication Engineers** are: president, M. E. Merchant, senior research physicist, Cincinnati Milling Machine Co.; vice president at large, W. E. Campbell, in charge of research and development in lubrication and organic analysis, Bell Telephone Laboratories; secretary-treasurer, W. H. Fowler, Jr., chief industrial lubrication engineer, Pure Oil Company; administrative secretary, W. P. Youngclaus, Jr., former regional manager, industrial division of the Alemite division, Stewart-Warner Corporation.

Conoflow Corporation, Philadelphia, has appointed **Bruce Greaves Company,** to represent Cono Controls in the St. Louis territory. Specializing in instrumentation and industrial power equipment, the company was founded in 1945 by Bruce Greaves. Last year James W. Bennett joined the firm, coming from a large instrument company in Philadelphia where he was general sales manager.

Kewanee Boiler Corporation and **Ross Heater Manufacturing Co., Inc.,** two divisions of the American Radiator & Standards Sanitary Corp., have combined to form a new company, **Kewanee-Ross Corporation.** Both units of Kewanee-Ross Corporation will continue to operate as before, however, the unification of the management, personnel and facilities of the two firms will provide a substantially broader scope of operations.

Bennet D. Jones, metallurgist at **Standard Pressed Steel Co.,** Jenkintown, since 1944 has been made manager of product devel-

NOW— DRY AIR for your equipment!

WESTINGHOUSE Type "W"
WATER-COOLED AFTERCOOLER

YOU CAN INSTALL WESTINGHOUSE TYPE "W" AFTERCOOLERS ON EXISTING EQUIPMENT . . . SPECIFY IT ON NEW EQUIPMENT

When buying new compressors—specify the Westinghouse Single-Stage "Y" for double the air and triple the protection . . . and the Type "W" Aftercooler for dry air delivery.

If moisture in your compressed air supply is causing complications—here's your answer! The Westinghouse Water-Cooled Aftercooler removes the moisture, delivers dry air to your machines.

Entrapped moisture is drained from bottom of header by removing plugs. Drain cock or automatic drain valve available as optional equipment.

Type "W" Aftercoolers are furnished in three sizes: for 1½ and 2 HP compressors; 3 and 5 HP compressors; and 7½ and 10 HP compressors. Price and dimensional data on request.

INDUSTRIAL PRODUCTS DIVISION
WESTINGHOUSE AIR BRAKE COMPANY
WILMERDING, PENNA.

Factory Branch: EMERYVILLE, CALIF. Distributors throughout the United States . . . Consult your Classified Directory.
Distributed in Canada by: Canadian Westinghouse Co., Ltd., Hamilton, Ontario.

opment, a new post created to speed up development of new products. **Robert L. Sproat** will succeed Jones.

David W. Jones, Jr., sales representative for the Tubular Products Division of the **Babcock and Wilcox Co.**, Beaver Falls, has opened new offices in the Goby Building, 1321 Bannock Street, Denver, Colorado. **Rockford Tool and Transmission Company, Rockford,** has been appointed as distributor of industrial tube fittings and related accessories manufactured by the **Parker Appliance Company,** Cleveland.

Sparkler Manufacturing Company, Mundelein, Illinois, has opened a new branch office and warehouse to serve the west coast, located at 612 N. San Vicente Blvd., Los Angeles 46, California. **Richards E. Shields** has been appointed west coast sales manager.

Harry F. Vickers, founder and president of Vickers, Inc., was elected president of the **Sperry Corporation,** to succeed Thomas A Morgan, retired. Mr. Vickers'

H. F. Vickers

K. R. Herman

association with the Sperry Corporation began in 1937 when Vickers Inc., became a Sperry subsidiary. **Kenneth R. Herman,** vice president and general manager and a director of Vickers Inc., was elected vice president of The Sperry Corporation. Both men will also continue in their present capacities at Vickers, Inc.

E. J. Martin has been appointed to the post of vice president and general manager of Sinclair's Harvey Research Center. Martin joined the Sinclair staff in 1929 after completion of his chemical engineering training at the University of Michigan. Also announced was the promotion of **W. M. Flowers** to the presidency of Sinclair Research Laboratories, Inc.

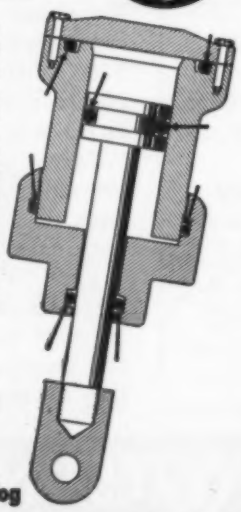
Pacific Airmotive Corporation announces the appointment of **Charlotte De Armond** as director of public relations. Mrs. De Armond's former aviation experience includes three years on the management control staff at Lockheed Aircraft Corp., and four years on the public relations staff of Douglas Aircraft.

David E. Williams has been appointed assistant sales manager of **Goshen Rubber Co., Inc.,** Goshen, Indiana.

O-RINGS by INJECTION MOLDING

Dependable Hydraulic Seals

Minnesota O-Rings function in air or gas systems as well as in hydraulic systems. Air cylinders . . . hydraulic valves . . . hoisting mechanisms . . . water pumps . . . bottling machines . . . refrigerators . . . motors . . . lubricators . . . are a few of their uses. Minnesota's exclusive injection process makes possible very close dimensions, uniformity in mass production and downright economy. We use special compounds of synthetic rubber to meet your exact requirements. Let us quote on your next hydraulic packing installation.



Manufacturers of all types of small rubber parts

Write for O-Ring Catalog

MINNESOTA RUBBER & GASKET CO.
3630 WOODDALE AVE., MINNEAPOLIS 16, MINN.

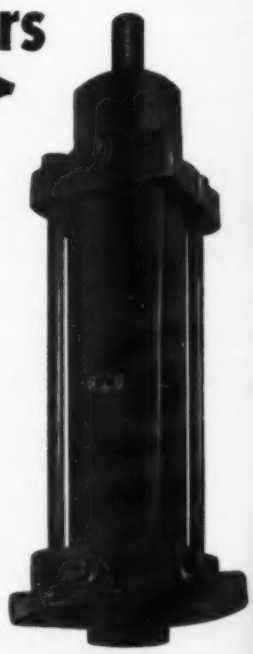
Circle 50 on Reader Service Card

PLUS VALUE in Air Cylinders

Designed and constructed to J.I.C. standards, NEPTUNE-POWER PLUS air cylinders are available in seven standard mountings for air powered applications to 200 P.S.I.

- Standard bores from 1 to 14 inches.
- Large bores and strokes made to customer specifications.
- One piece, self-adjusting, rod packing provides precision bearing and guide for piston rod.
- Single or double end rods with adjustable or self-regulating cushions.
- Other series built for water and oil service to 3000 P.S.I.

Write for Catalog AH



NEPTUNE-POWER PLUS PRODUCTS CO.
2228 Bellevue Ave. Detroit 7, Michigan

Circle 51 on Reader Service Card

Leigh H. Norgren has been appointed plant superintendent of the C. A. Norgren Co., Mr. Norgren has been working as an industrial engineer in the plant for about two years. Recently he has been assistant to the factory manager.

Carl Sadler of Sundstrand Machine Tool Company, Hydraulic Division, is the new chairman of the Aircraft Accessory and Equipment Division of the SAE Aeronautics Committee. Sadler has also been appointed a member of this top aeronautics group by SAE Aeronautics Committee chairman Bill Lawrence.

S. Arthur Loeb, president of the **Webster Electric Company** for 26 years has been elected as chairman of the board. Succeeding Mr. Loeb as president is former vice president and secretary Arthur C. Kleckner. Other officers of the board are Preston G. Crewe, executive vice president and treasurer, and Frederic A. Fischel, vice president and secretary.

The **Rocky Mountain Machinery Company,** Salt Lake City has been named the new distributor in Utah and southeastern Idaho for the **New York Belting and Packing Company.**

Sperry Products, Inc., of Danbury, appointed **Walter L. Wise, Jr.** to the position of industrial sales manager. Mr. Wise was formerly sales manager of the Kingston-Conley Division of The Hoover Company.

Hydropress, Inc., New York, has appointed **Jacques W. Lourie,** director of foreign sales. Mr. Lourie, a mechanical engineer, has been a leading staff member for more than a decade.

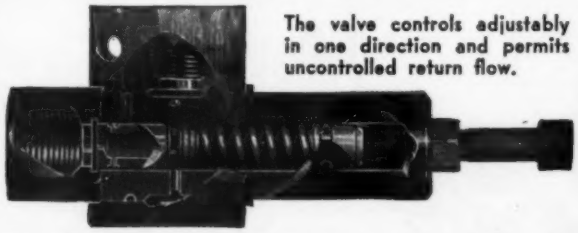
Norbert Beerli has been recently employed by **The Paquin Company, Cleveland,** as a hydraulic engineer to assist in applying the products they sell to customers' machines and hydraulic installations.

Seven regional industrial sales managers have been named by **Minneapolis-Honeywell Regulator Company.** Those appointed and the regions in which each will have charge are: Jack E. MacConville, the southeast with headquarters in Atlanta; Alfred J. McCullough, the central region with headquarters in Cleveland; Howard L. Marston, the northwest with headquarters in Minneapolis; Robert L. Mallory, the southwest with headquarters in Dallas, Robert B. Grant, the pacific and mountain region with headquarters in Los Angeles, and Lester W. Williams, the pacific northwest with headquarters in Portland.

E. L. Black has been appointed acting manager of the Manufacturing division of Pacific Airmotive, following the resignation of former vice president, Richard D. Maystead.

An adjustable
FLOW REGULATOR

This newly perfected adjustable Flow Regulator holds at a constant rate even though the pressure fluctuates.



The valve controls adjustably in one direction and permits uncontrolled return flow.

The spring back piston in the housing is mounted in front of the adjustable screw. It carries a calibrated orifice; operates axially on change in inlet pressure so as to increase the throttling action.

Four sizes, 1/4, 3/8, 1/2, and 3/4 inch. Overall length, 4 1/2 to 7 1/2 inches. Adjustable over a 50% flow range. Maximum pressure is 3000 pounds.

Write for illustrated circular.

WATERMAN ENGINEERING Company
725 CUSTER AVENUE • EVANSTON, ILLINOIS

MONOPAK METALLIC PACKING

Prolongs the Life of Hydraulic Cylinders

• Seals against Oil, Water, Brine, Air, Gases and Refrigerants •

ASSURES UNEXCELLED DURABILITY

Burst-proof, does not blow out . . . Compact and easy to install . . . Low Friction insures long life. Now adopted by hundreds of manufacturers and users of machine tools.

Write for Literature

HYDRAULIC ACCESSORIES CO.
439 E. Fort St. • Detroit 26, Mich.

Mobile Servicing Truck Designed To Fuel Rocket Engines

A SPECIAL 12½ ton mobile rocket engine servicing truck for rapid fueling of rocket engines has been put into service by Republic Aviation Corporation. Because rocket planes cannot be fueled until just before take-off, due to the highly volatile nature of the fuel used, the new service truck has been used initially to fuel interceptor planes like the Republic XF-91, planes designed to head off hostile aircraft before they can strike.

Delivers Two Fuels

Two types of fuel are delivered—liquid oxygen and a water-alcohol mixture. The liquid oxygen is stored in a 900 gallon, doublewall, specially insulated tank mounted on the rear of the truck. The liquid oxygen is kept in its liquid state at minus 300 F indefinitely since the tank is actually a giant thermos bottle. The liquid oxygen is supplied to the airplane by means of pressurized gas, supplied by commercial cylinders installed on the truck. Eight nitrogen bottles are carried on the truck. Nitrogen is serviced separately for the airplane's pressurization system.

FIG. 1. THE SPECIAL MOBILE rocket engine servicing truck carries liquid oxygen (rear), a water-alcohol mixture in tanks, nitrogen in bottles for fueling and pressurizing rocket engines and plane pressurization systems. The truck services all three fluids simultaneously and safely.

The second major fuel, the water-alcohol mixture, is supplied to the airplane by means of a motor driven

4-WAY SOLENOID OPERATED AIR-VALVE only $32.50

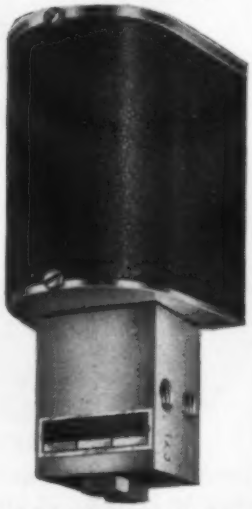
Compact sturdy construction, precision engineered for long, uninterrupted heavy duty operation.

Has small, well protected solenoid—operates small cylinders up to 3" dia. and larger cylinders where unusual speeds are not required.

Quantity and O.E.M. discounts. Write for description, discounts, etc.

IMMEDIATE DELIVERY

For Fast Operation of Cylinders up to 3" Diameter



3-WAY VALVE
Same Design
only $19.80

AUTOMATIC VALVE CO.
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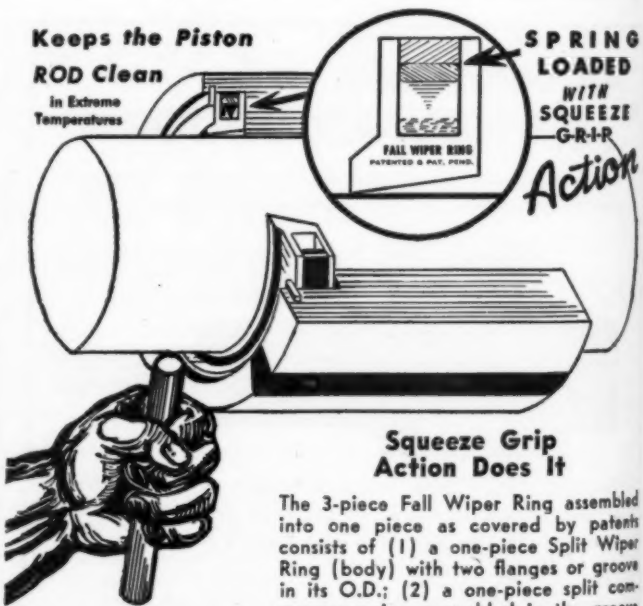
Keeps the Piston ROD Clean in Extreme Temperatures

SPRING LOADED WITH SQUEEZE GRIP Action



Used During World War II and ever since by the Military

Fall Wiper Rings Spec. MIL-S-5049 are AN Approved.

Covered by patents issued and patents pending

Squeeze Grip Action Does It

The 3-piece Fall Wiper Ring assembled into one piece as covered by patents consists of (1) a one-piece Split Wiper Ring (body) with two flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in the groove (3) an endless cover band surrounding the spring in the groove which causes a squeeze grip action on the piston rod.

The Fall Wiper Ring is available from ½" to 13" dia. Military part numbers from AN6231A1 to AN6231A71. Write, wire or phone us regarding your wiper needs.

Ace Products Company
Toledo 1, Ohio Phone ADams 6513

Fall Wiper Ring SPRING LOADED

Circle 8 on Reader Service Card

Circle 1 on Reader Service Card

pump from the 700 gallon tank mounted on the forward end of the truck.

The truck also carries an Air Force type B-8 engine-generator, a compressor and a fire extinguishing system. The latter is essential because inadvertant or premature mixing of liquid oxygen and the water-alcohol mixture could cause a disastrous explosion.

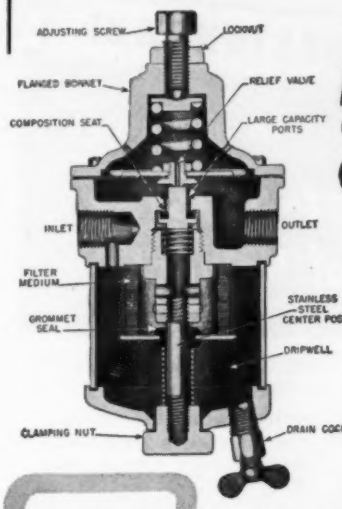
Speeds Fueling Time

Prior to the introduction of the special service truck, fueling of rocket-propelled aircraft has been a relatively long process. The X-1, the first airplane to fly faster than sound (see Harold E. Well's article in June issue) was fueled by placing the craft under the liquid oxygen storage tank and allowing the fuel to feed by gravity from the tank overnight. The D-558, second announced supersonic plane, was fueled with liquid oxygen at a remote storage tank and the airplane was then transported on a special truck to the test base. In both cases, the second essential propellant—the water-alcohol mixture—and the pressurizing nitrogen gas were serviced in separate operations from portable facilities.

The Republic truck is the first unit of its type capable of servicing an aircraft with both propellants and the pressurized gas simultaneously from a single source.

Republic's XF-91, now undergoing extensive tests at Edwards Air Force Base is powered by a turbojet engine but depends for emergency, superpower on rocket engines and afterburner.

Circle 13 on Reader Service Card



DOUBLE VALUE

CONO AIRPAK

—REGULATES

—FILTERS

IN A SINGLE UNIT

The advantages of a high quality large capacity reducing valve with safety relief, and an efficient air filter, are combined in a single compact unit. Save space and installation costs by eliminating the use of separate units. Pressure gauge can be mounted integrally. Construction is rugged, corrosive resistant and long lasting. Available in a variety of ranges and dripwell capacities for production equipment, instruments and controls, spraying equipment, and pneumatic gauges. Write for BULLETIN FH-15 to get full details.

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Cono Controls

CC-116

Tell Us Your Production Problems . . . We'll Help You Solve Them

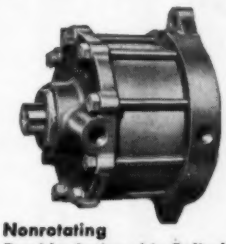
"LOGAN" Rotating and Nonrotating AIR CYLINDERS

Fast-Acting, Positive Controlled Power . . . At LOW COST

NONROTATING—
7 STANDARD MOUNTING TYPES

Standard sizes from 1½" to 12" bore; maximum stroke, 18 feet. Special models to meet your requirements.

Logan Features—Larger Ports . . . More Sturdy Construction . . . Maximum Power Without Leakage . . . Permanent Seal Around Piston Rod . . . Standard Models With or Without Cushioning.

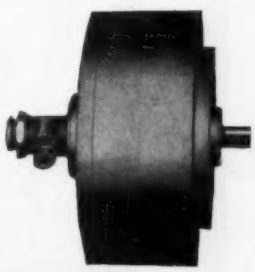


Nonrotating Double-Acting Air Cylinder

ROTATING—

Two Standard Styles—Model R with cast iron body; Model K with lightweight aluminum body.

Bore diameter 1½" to 20"; piston stroke 1" to 2"; longer strokes available as special. American Standard adaptations; simple, efficient design to assure positive, rapid, economical operation.



Rotating Air Cylinders

FLUID POWER SPECIALISTS SINCE 1916

Logan Manufactures 6,975 Standard Cataloged Items

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AIR CHUCKS CATALOG 70-1
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COLLET GRIP TUBE FITTINGS CATALOG 44
HYDRAULIC CONTROL VALVES CATALOG 200-4
HYDRAULIC CYLINDERS CATALOG 200-2; ALSO 200-3
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Let Logan Engineers help you design your Air and Hydraulic Circuits.

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Air and Hydraulic Equipment

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NEW *Pilot-Master* Air Control Valves!

HERE'S WHY MAINTENANCE MEN PREFER THEM...

FEWER VALVES TO STOCK
Use same valve 2-way or 3-way, normally open or normally closed.

FEWER PARTS TO STOCK
Unique cartridge construction makes "insides" easily replaceable.

INDUSTRIAL SOLENOIDS
Long-lasting, easy to change coils to any standard voltage.

All Sizes From ¼" to 1¼" I.P.S.
Pressures From 15 to 150 P.S.I.
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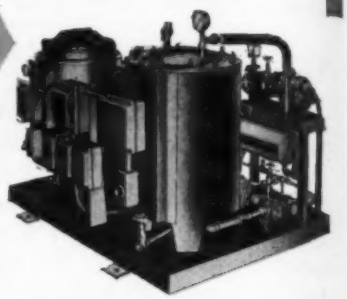
Restores used hydraulic oil to like-new condition

HOFFMAN OIL CONDITIONER



Removes soluble and insoluble impurities
Capacities from 25 to 600 g.p.h.

Protects your hydraulic equipment—lengthens oil life without high maintenance cost of centrifuges. The Hoffman Oil Conditioner consists of a cartridge filter and vaporizer, mounted on a common base, portable if desired. Complete with all necessary electric and pump connections. Only two moving parts—no steam or water connections. Write for technical bulletins.

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U.S. HOFFMAN MACHINERY CORPORATION

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CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO. LTD. NEWMARKET, ONT.

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INSTANT RESPONSE

HYDRAULIC REMOTE CONTROLS

FOR
AVIATION, AUTOMOTIVE, RAILROAD, MARINE AND MACHINE TOOL INDUSTRIES

Every motion applied to the transmitter is duplicated INSTANTLY and POSITIVELY. The self-contained, single tube system is simple, reliable, easily installed.

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REPRESENTATIVES IN PRINCIPAL CITIES

WAR SURPLUS SAVINGS

SAVE UP TO 85%

NEW INSIDE – OUTSIDE VERNIER CALIPERS
German made by one of Europe's leading specialists in precision tools. Measures inside-outside & depth in .001" to 6" in 1000ths and 1/10mm to 150mm in 10ths. 9.75
MICROMETERS – 0" to 1" in 1,000ths. Has lock-nut & ratchet ...ONLY – . . . 9.75

STAND MAGNIFIER 1.99
Handy stand magnifier with universal adjustments. Overall height: 6". Has powerful, clear magnifying lens.

BENDIX HYDRAULIC PUMP & MOTOR
Has 3-1/2 GPM capacity at 600 PSI. Motor is 1½ HP, 24V, D.C. Will operate on either 12 or 32V, DC current. Has built-in relief valve adj. to 1500 PSI. This unit ideal for hyd. lifts, portable loaders, etc. 19.50

MAGNETIC BASE–INDICATOR HOLDER...
A time saver for precision checking. Magnetic base fits curved or flat surface. Has 45-50 lb. pull. Stainless steel 6½" rod mounted in ball socket permits universal settings. 3.50
Note: We have complete line of instruments, depth gauges, inspection mirrors, etc. WRITE TODAY

HYDRAULIC HAND PUMP
Operating pressure 2000 PSI. Cap., 1.5 cu. in per complete cycle . . . 12.75

GEAR HEAD MOTORS
Heavy duty, G.E. Gear Head motor. 2 HP, 24V. DC. 125 amp., reversible motor drives a reduction gear unit giving 36 to 1 ratio at take-off. Also will operate on 6 or 12 volts.
MOTOR ALONE 9.95
GEAR BOX 7.95
36 to 1 G.E. (306 shaft RPM)
28 to 1 Eclipse (130 shaft RPM)
40 to 1 Eclipse (110 shaft RPM) 10.95 EA.

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A-2B FLOATING PISTON TYPE – 4"x 18" Built to stand 2,000 PSI 12.75
A-5 VICKERS – 10" dia. Ball type. Built to stand 2000 P.S.I. 19.75

ELECTRIC ACTUATORS
Hundreds of uses for any mechanical device needing controlled 2 way action. Opens, closes, raises or lowers doors – windows – gates – valves.
CTU-2 – Feeto Linear Actuator – 24 volt, DC, 8500 RPM, 1/6 HP – series wound motor. 4½" stroke in 13½ sec. Compression and tension loads up to 750 lbs. Adjustable micro switch for limits of travel. Overall lngth., retracted 11" 7.95
We also carry many more sizes and types of Actuators. Write today for information.

HYDRAULIC CYLINDERS
Gives 20,000 lb. thrust (push or pull) using 1500 PSI line pressure as obtained from our hydraulic pumps. Will produce up to 40,000 lb. thrust with 3000 PSI. Can also be used on low pressure air systems. 4" bore; 18" stroke; 30½" length. Ideal for ram force – shop machinery. 29.95

No. 3 HYDRAULIC CYLINDER
Double action. Bore is 1" – Shaft ½". Has stroke of 2½" to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8½". Will take 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 1100 lbs. 5.75
We stock over 50,000 Hydraulic Cylinders, Valves, Pumps, Accumulators, Hand Pumps, Motors, Hose, etc. All at Money Saving Prices.

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Order from this ad. Pay by M.O. or check. P.O.'s accepted from D&B firms. ½ deposit with C.O.D.'s.
All Prices F.O.B. Los Angeles

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British Aeronautical Exposition

Meets in September

THE major annual British aeronautical show, The Society of British Aircraft Constructors Flying Display and Exhibition will be held September 2 to 7 at The Royal Aircraft Establishment at Farnborough, England, by courtesy of the British Ministry of Supply.

All the major British aeroplane and engine manufacturers will display their products and the usual impressive flying demonstrations will be given by the leading test pilots in the industry.

Indoors, the static section of the show will be an exposition of piston and jet engines, auxiliary components for airframes and engines, as well as comprehensive range of ground maintenance and airfield equipment. The principal airplane hydraulic and pneumatic specialists will display their latest products.

Develops "G" Restrictor

For example, British Messier Ltd., of Cheltenhem, have recently developed a hydraulic "G" restrictor to warn pilots when approaching a critical acceleration in high speed maneuvers, by imposing a load on the control column (rudder) to oppose the pilot's efforts. Briefly, this system comprises an electrically powered gear pump immersed in its own reservoir, circulating oil through a "G" sensitive variable flow valve which restricts the return flow to tank as the "G" factor increases. When the pilot exceeds 1.5 g, as for example in a tight turn, the "G" valve partially closes the return to tank line and the pressure builds up a load on the control column through the hydraulic cylinder, warning the pilot that he is overstressing the aircraft. This pressure, being progressive, can increase to a degree which makes it impossible to exceed a predetermined "g" load.

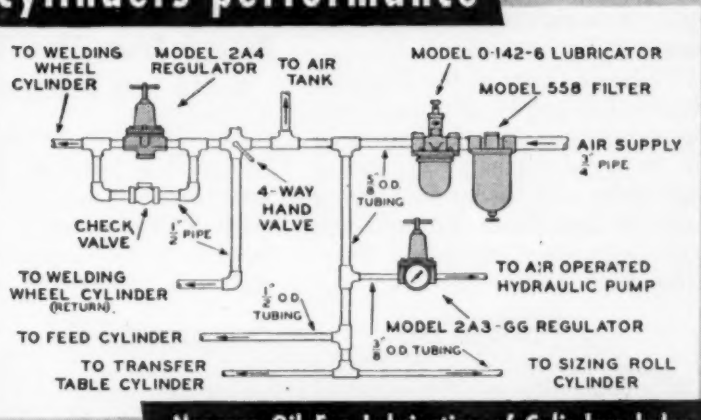
Among the range of hydraulic valves, motors and selectors to be shown by Integral Ltd., of Wolverhampton, will be the type 180, Mark I pump, as fitted to the latest aircraft built by English Electric Ltd. This pump embodies the two-stage principle, in which a low pressure gear stage feeds a high pressure stage, the latter a seven piston radial pump. A more elaborate three-stage pump, with two gear stages feeding the third single piston stage, will also be shown.

Aircraft pneumatic systems are securing increasing attention from aircraft designers; the Hymatic Engineering Co. Ltd. of Reddich, will exhibit small, high power air compressors, systems and components suitable for working pressures up to 3000 psi.

Filter Developments

Vokes Ltd. will show aviation filters for fuel, lubricating oil and hydraulic systems, as well as air filter panels, the latter for air intakes of piston engines in current use for training and transport aircraft and helicopters. Two new developments, the first a high temperature air filter for use in hot air ducts in high altitude fighters (crew

NORGREN improves air cylinders performance



Norgren Oil Fog Lubrication of Cylinders helps National Welder attain 1000-per-hour Output

PLANT REPORT
NATIONAL ELECTRIC WELDING MACHINES CO.

PROBLEM: To provide positive, trouble-free lubrication of 4 air cylinders and one air-operated hydraulic pump for a special 200 KVA Welder which automatically roll-forms, sizes, feeds and mash-seam welds metal containers up to 25" in diameter.

SOLUTION: Use of Norgren Filter, Regulator and Lubricator system which cleans, regulates and lubricates the air used to power the pneumatic units on the Welder.

RESULT: The Norgren equipment provided the efficient, dependable lubrication, air regulation and air cleaning required for continuous high speed operation— thus saves time and money for the National Welder users by reducing maintenance and costly down time, and minimizes the amount of servicing by the manufacturer. National Electric Welding Machine Company says: "We have standardized on Norgren air accessories for nineteen years and have found them to be extremely satisfactory."

- Hose Assemblies
- Regulators
- Valves
- Filters

FASTER DELIVERY RESULT OF NEW PLANT FACILITIES

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Gentlemen: Please send me your free Norgren Blueprint No. 113-A, giving complete data on above lubrication system.

Name_____

Address_____

Company_____

compartments and gun firing mechanisms at low ambient temperatures), the second a pressure filter for cabin superchargers of the new Bristol Britannia air liner.

The Fairey Aviation Co. Ltd. will display, in addition to complete aircraft, the Fairey hydro-booster power flying control system. This company also manufactures deck-landing arrestor gear for naval aircraft and oleo-pneumatic shock struts.

Packings and Seals

The Dowty Group will show a wide range of hydraulic components, including gas turbine fuel pumps and systems, landing gears of both oleo-pneumatic and Liquid Spring designs and the latest developments in high pressure hydraulic pumps and valves.

The main theme of the Precision Rubber Ltd. exhibit will be to convey the company's specialization in the range of synthetics applied to pneumatic and hydraulic sealing problems for aircraft. Pressure control diaphrams of rubberized Nylon glass cloth and similar synthetic fabrics and "O" rings will be shown. This company has done some interesting development in the manufacture of rubber pressure reservoirs.

Hall and Hall Ltd., packing manufacturer, will show examples of their Rodam rings, cups and Intersetting rings, in addition to a complete line of "O" rings molded to British Standard specifications.

In the Airfield Equipment section Brown Brothers (Aircraft) Ltd. will show a range of hydraulic jacks. Skyhi Ltd. will also show hydraulic jacks, including very large sizes for freighters and troop carriers.

J. A. L.

National Power Show to be Held in New York December 1 to 6

The Twentieth National Exposition of Power and Mechanical Engineering will be held in Grand Central Palace, New York, December 1 to 6, 1952. Sponsored by the American Society of Mechanical Engineers, whose annual meeting will be in session during the same week, the biennial event will include exhibits representing every kind of equipment used in the generation and distribution of power.

There will be upwards of three hundred different kinds of products on display, occupying three entire floors of the Palace.

New TEMA Standards Book

The third edition of "Standards of Tubular Exchanger Manufacturers Association" has just been published. This new edition comprising 162 pages, has been revised and enlarged, having added 58 more pages than the last edition issued in 1949. Apart from additions to the mechanical and thermal standards to conform with current findings and conclusions, two entirely new sections have been added. One gives the mechanical standards for alloy steel heat exchangers and the other contains general information valu-

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CYLINDERS

The New Series 2000-S and 2000-D

Here is the Cylinder you have been looking for!
FINEST QUALITY and PERFORMANCE at MINIMUM COST!

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* Double Action
* Any Bore
* Any Stroke

Whether your primary problem is performance, delivery or price it will pay you to contact BRUNING today.

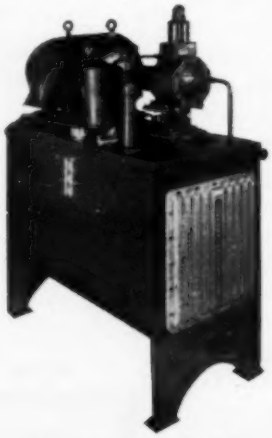
Complete specifications, and prices will be forwarded upon request.

NOTE—Bruning cylinders comply with the latest A.S.A.E.—S.A.E. standards for farm implements.

the Bruning Company LINCOLN NEBRASKA
DESIGNERS AND MANUFACTURERS OF PRECISION HYDRAULIC EQUIPMENT

Last Word in...
ENGINEERED HYDRAULIC DELUXE
Package Units

"If it's Hydraulic, Century Designs & Builds Them"



We specialize in 30 to 500 gal. reservoir units with any makes or combinations of the commercial lines of pumps and valves to meet your specs.

We modernize your present equipment in use now; let us propose our manifolded valve mounting panels to cut down-time, by eliminating cause.

Our units were designed to meet or to surpass all "J.I.C." standardizations and not copied from other existing similar power units.

Several Styles from Stock—Write for Details

CENTURY HYDRAULICS, INC.
18135 JAMES COUZENS HIGHWAY • DETROIT 35, MICHIGAN

able to designers, fabricators and users of heat exchangers.

In order to make the 1952 Standards a single completely self contained reference source for designers and users, a general information section has been included, which brings conveniently together in one volume with the TEMA standards, not only other helpful data formerly obtainable only from scattered sources, but tables just recently made available on maximum allowable stress values of carbon, low and high alloy steels, nickel and high nickel alloys, copper and copper alloys, carbon and low carbon steel pipe and tubes.

The book is available to nonmembers of the Association at the publishing cost of $5.50.

Template Drafting Speeds Electrical Control Layout

Drawing circuit layouts for electrical control systems is normally one of the most tedious and time consuming jobs in an engineering drafting department.

NEW DRAFTING BOARD process, which cuts a third off the time used in laying out engineering drawings, makes use of equipment "miniatures" or templates containing small permanent magnets.

In 1950, The Reliance Electric & Engineering Co. developed and standardized on what they call the "Ree-Copy" Template Drafting process. It is conservatively estimated that efficiency of Reliance draftsmen has been increased by 30 percent with a similar savings in "board hours."

Preparing an efficient layout of electrical switches, relays, timers, and terminal boards on a control panel often requires several drawings before a satisfactory arrangement is reached. Because many of the components are the same, the drawing job becomes monotonous. To make alterations on a complex circuit is costly.

The new drafting technique simplifies circuit drawings by the use of accurately scaled plastic templates for each component. The "drawing board" is metal faced and a photo sensitive sheet is used. Each template contains a small permanent magnet which holds the template fixed after the draftsman has positioned the templates into any desired configuration. The complete assembly is then exposed and developed. The photosensitive material may be ordinary "blueprint" or "whiteprint" paper.

The print provides a rough layout on which the draftsman draws

NEW SKINNER SOLENOID VALVE

EXPLOSION PROOF TYPE X5

THE new Skinner X5 Solenoid Valve is basically the same as the widely accepted and tested V5, but modified to a construction that is Underwriters' approved for Class I, Group D hazardous locations. Small size and lightweight features are retained, and the X5 is low in price because of the many parts which are interchangeable with other Skinner valves. Rating is 10 watts max.; soft, spring loaded seals prevent leakage; internal parts are stainless steel; wide variety of port locations in 1/8" and 1/4" size; most types available for metering; for AC or DC in a wide range of voltages and frequencies; can be mounted in any position; supplied as two-way normally open or closed, three-way normally open, closed or directional flow. *Write today for details!*

SKINNER ELECTRIC VALVE DIV.
THE SKINNER CHUCK COMPANY
142 Belden Ave., Norwalk, Conn.

New "HIGH" in Pressure Recording

... up to 80,000 p.s.i.

Foxboro offers the most complete line of highly accurate pressure instruments available. Diaphragm, spiral and helical spring, and bellows-type elements of phosphor bronze, beryllium copper, steel or stainless steel, for a wide selection of ranges from 2" of water to 10,000 p.s.i. Also, a new heavy-duty helical spring of Type 316 Stainless Steel now provides accurate measurements in full or expanded ranges from 50 to 80,000 p.s.i. . . . even in pulsating service. Choice of round or rectangular cases. For specific information on your problem, write **The Foxboro Company, 218 Norfolk Street, Foxboro, Mass., U.S.A.**

FOXBORO PRESSURE RECORDERS
Reg U.S. Pat Off.

in the wiring. If a change is necessary, another layout is easily made.

Use of templates requires some standardization on components so that a complete set of templates can be available. Having eliminated the human error in detailing components, template-made layouts are more accurate as well as less costly.

Yarnall-Waring Expands Plant Facilities

More than 850 employees, friends, customers, distributors and suppliers were guests of the Yarnall-Waring Company, Philadelphia at a recent "Open House".

Featured attraction of the event was a series of conducted tours through the expanded plant and new office buildings.

One of the high points of interest was Yarway's well-known research department where a 2500 psi boiler plant tests Yarway equipment and helps develop many new advancements in steam equipment engineering and high pressure valves.

The Yarnall-Waring Company was founded in 1908 by Bernard G. Waring and D. Robert Yarnall who continue to actively headup the company.

THE MARKET PLACE

CLASSIFIED ADVERTISING

Rates: For "Positions Wanted" $4.00 minimum, limit 25 words. For all other classifications. $4.50 minimum for 25 words, each additional word 15c; bold face type or all capitals, $7.50 minimum for 25 words, each additional word 20c; limit 50 words. Box addresses count as five words. All insertions are payable in advance.

ENGINEERS WANTED

A progressive Cleveland, Ohio, manufacturer, maintaining a well balanced production schedule in govt. and industrial contracts, has several openings for development, process and design engineers. Graduate and non-graduate engineers seeking a permanent position permitting rapid advancement commensurate with ability are invited to send a complete resume including qualifications, salary requirements, education, etc., to Box 8152 APPLIED HYDRAULICS.

MANUFACTURING REPRESENTATIVES AND DISTRIBUTORS

Prominent manufacturer of air and hydraulic cylinders has openings for those qualified. Please state experience, lines carried, and territory extent. Replies kept confidential. Box 7152 APPLIED HYDRAULICS.

DESIGN ENGINEER WANTED

Hydraulic components; 5 years experience aircraft or industrial products. Exceptional future assured for man with ability in these fields. Permanent position in Brooklyn plant. Write giving full experience, background and salary requirements to Mr. L. Copple, Greer Hydraulics, Inc., 454 18th St., Brooklyn 15, N. Y.

COMPRESSED AIR AND GAS COME OUT OF THE LOGAN

ARIDIFIER

Scrubbed CLEAN AND DRY

INSTALL ARIDIFIERS ON LINES SERVING

- Paint Spray Guns
- Air Tools
- Air Hoists
- Foundry Jogging Machines
- Sand Blasting Tools
- Sand Blasting Rooms
- Metal Spray Guns . . . or Wherever the line must deliver clean, dry air or gas

On any air or gas line 92% of the dirt, oil, scale and water that enter the Aridifier is trapped and removed from circulation. The Aridifier's patented centrifugal-baffle action scrubs air and gas clean and dry . . . protects equipment, prevents freezing, fouling, corrosion and caking, produces best results with spray gun and air tool operations, etc. Easy to install. Self cleaning. Maintains itself. 10 models available. Capacity 7 CFM to 17,000 CFM.

Learn HOW the Aridifier scrubs with a patented centrifugal-baffle action.

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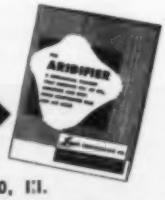

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SPECIAL PURPOSE

Power Package

Assures positive cylinder control on payoff reel.

The photo illustrates a special power unit with valves mounted. It contains all the necessary check valves; solenoid controlled, pilot operated four-way valves; flow control valves; accumulator and pressure switch on the cover. This equipment is for cylinder controls on payoff reel. Only the pressure lines from the four-way valves to cylinder ports will require piping in the field. The Hydro-Pneumatic accumulator is used for maintaining pressure to keep coil drum expanded during payoff cycle.

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Custom & Standard Hydraulic Power Units

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(Youngstown Suburb)

Circle 39 on Reader Service Card

Fluid Powered Chucks Increase Production

Concluded from page 55

other equipment using air and long runs of air distribution lines must be installed, it is often less expensive to use hydraulics.

Increased production with the use of power chucking equipment is made possible by the automatic action of the machine in assuring that the work piece is always in the same position; by the elimination of variation in pressure of hand operation and the operator fatigue factor; and by the reduction of loading and unloading or chucking time. A study by a leading lathe manufacturer showed that tests run on round pieces, light enough to be lifted into the chuck by hand, gave, with air operation, a saving up to 80 percent in cycle time and an average of 73 percent time saving.

Scrap Losses Lowered

Scrap losses may be reduced in several ways: (1) gripping or holding pressures are always identical or adjustable to the most desirable pressure; (2) reserve movement is available to adjust for work piece irregularities; and (3) high gripping power when needed. The first eliminates operator error due to carelessness or fatigue or by the use of tandem rotating cylinders permits different sets of jaws to be set at different holding pressures; the second corrects against slippage or tool breakage caused by the work piece becoming loose in the chuck; and the third assures plenty of gripping power for heavy chip removal at high speeds, a requirement for the new high cutting tools.

Air or hydraulic chucking equipment will give many years of rugged service with the minimum amount of maintenance. Many air chucks in constant operation for 15 to 18 years are still giving satisfactory service. Chucks should be cleaned and lubricated at regular intervals. If used to machine cast iron or other metals which cause small chips and dust, they should be disassembled occasionally and thoroughly cleaned.

Holding Irregular Shapes

Irregular shaped and other than round work pieces can be chucked in a power chuck as long as the false jaws are correctly designed. False jaws may be designed with diamond or straight serrations for roughing operations, smooth for use on finished surfaces. A few straight serrations on mandrel jaws hold better than a larger number since higher gripping line pressure allows the serrations to dig into the work piece, eliminating any possibility of slippage.

This article is adapted from a paper given by Mr. Stewart at the 1952 ASTE national meeting, March, 1952

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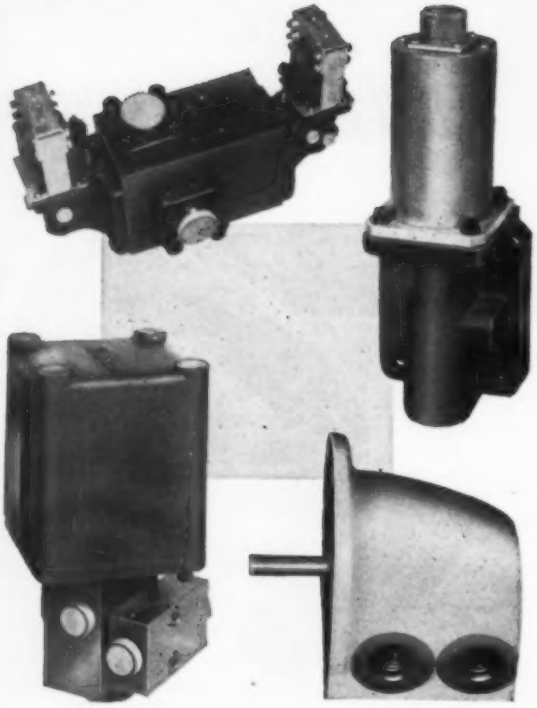

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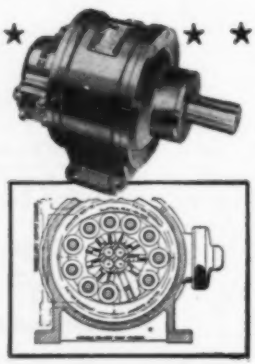

Superdraulic CORPORATION

14256 WYOMING AVE. • DETROIT 4, MICH.

Controlled Pressure System

Concluded from page 47

controlled valves are operated from either of the two push button stations.

Sequence of Operation

Pressing the "centers in" button brings in the headstock center, so that it projects beyond the driver plate; then a sequence valve causes the tailstock center to be brought in. The combined capacities of the duplex pump and combination pump are used in this operation to speed up this motion. A check valve in the hydraulic system is provided so that, in case of power failure, the centers cannot retract and allow the axle to drop.

The operator then brings in the burnishing rolls and starts the longitudinal feed in either direction as desired. After completing one end of the axle, this operation is duplicated at the other end of the axle. Both journals of the same axle can be worked on simultaneously if the operator is adept. The hydraulic circuits to every carriage are independent so that in case the operator desires to burnish both journals simultaneously one circuit cannot effect the other.

When all operations on the axle have been completed, pressing the "centers out" button allows the axle to drop onto the work rest.

The spindle drive motor is electrically interlocked so that in case the spindle stops, hydraulic pressure is removed, thereby stopping the burnishing roll pressure and the carriage feed. When the spindle is running, an interlock prevents operation of the solenoid valve for withdrawing the centers from the axle. A pressure switch located in the "centers in" pressure line will stop the spindle drive motor if the pressure drops below a safe operating limit.

The adjustable flow control valves in the rod end lines of the burnishing roll cylinders permit speed adjustment on the rapid advance stroke.

Selection of high or low pressure for burnishing is made by pressing respective push buttons which energize the solenoids on the pressure selector valves. These valves are 4-way, two position, double solenoid operated. Energizing one solenoid, shifts the valve so that pump pressure is determined by the setting of the built-in pump relief valve. This will be the high pressure setting. Pressing the "low pressure" button will shift the selector valve to make pump pressure dependent on the setting of the low pressure relief valve.

An additional power saving feature is provided in the left hand carriage circuit by a cam operated vent valve which is opened when the headstock center retracts to permit unloading of the work. If, at this time, the pressure selector is positioned for high pressure, the high pressure relief valve will be vented to atmosphere and the pump supplying oil to the left hand carriage will unload its volume at near zero pressure.

This is the design of the axle burnishing lathe which has resulted in a system that is easily operated and offers an infinite range of tool feed rates at positively controlled pressures.

Spray Cabinet Drive

Concluded from page 44

and therefore reduces the length of conveyor as well as the size of the drying oven.

On a typical four station spray system, carrying four front fenders on one spinner and two hoods and four tire shields on the second spinner, the workholder spacing is aproximately 7 ft. Length of cabinet travel depends on the conveyor speed. When the work holder reaches the booth, a dog on the conveyor works against the valve arm linkage to position the valve spool to a point which will permit a measured flow of oil to the cylinder which moves the cabinet. If the conveyor speed changes, the valve linkage shifts to meter the flow of oil and change cabinet travel. This linkage is described in the accompanying drawing.

At the end of cabinet travel, the valve arm is released and oil is directed to the cylinder rod end to return the cabinet. Because each cabinet operates for every other work holder, time of return presents no problem. The cabinet is back to starting position before the work holder moves in front of the spray cabinet.

The side elevation and plan view of the machine illustrates the travel pattern and the simplicity of the hydraulic system.

Applying oil power to this high production operation has reduced painting costs, simplified conveyor and oven layout and improved the quality of the finished product.

Circle 52 on Reader Service Card

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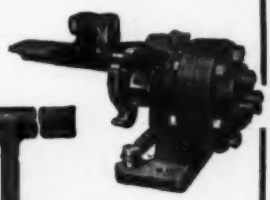

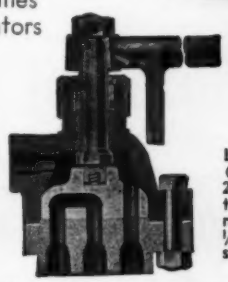

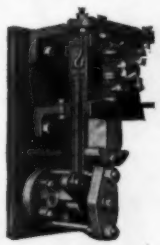

Lever models (left), ¼" to 2½", pressures to 5000 lbs. Foot models (above), ¼" to 1½", pressures to 300 lbs.

Motor (left) and solenoid types, ⅛" to 2½"; pressures to 375 lbs.

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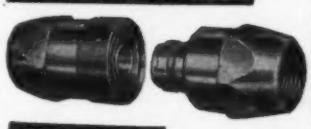
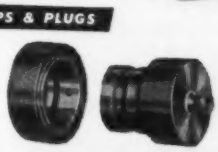


CAPS & PLUGS



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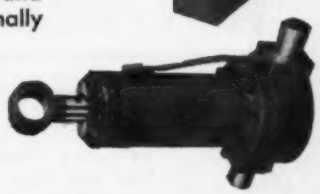

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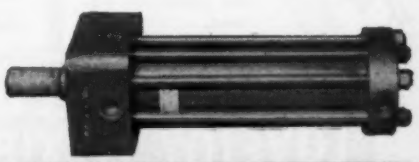

LYNAIR, INC., Jackson, Michigan

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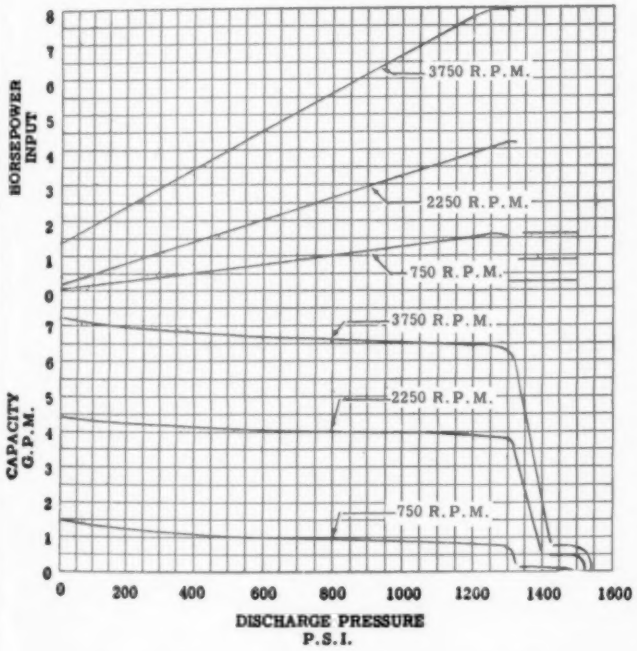

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